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[OFFICIAL NOTICE.]

Annual Meeting, American Gas Light Association.

LAWRENCE, MASS., July 29, 1889.

Section 12 of the Constitution is as follows:

"12. Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on."

To the Members of the Association: Gentlemen—The Seventeenth Annual Meeting of the Association will be held at Baltimore, Md., on Wednesday, Thursday, and Friday, Oct. 16, 17, and 18. The headquarters of the Association will be at the Carrollton Hotel, which is conducted on the American plan. The meetings of the Association will be held in the Concert Hall of the Concordia Building, on German street near Eutaw.

Members should secure rooms at the hotel by writing in advance to the proprietor. The rate will be $3 per day. Past experience should induce the members to write well in advance for hotel accommodations, and to be very explicit in stating what kinds of rooms are desired. If the members would adopt the further precaution of inclosing in their letters to the hotel proprietors a properly addressed and stamped return envelope, with a request that the writer be informed whether he can secure such accommodation as he desires, much annoyance might be prevented. In the past, members have written to the hotel selected as headquarters requesting that certain kinds of rooms be reserved for them; but the hotel people could not fill the requirements, and had booked them for rooms of a different kind, without notifying the applicant of the change. The members, presuming that silence means consent, come to the meeting expecting to find reserved for them such rooms as they had bespoken, and failing in this have been disappointed. If the members would adopt the hint already given, and request an answer to their applications, trouble on this score might be prevented. In addition to the Carrollton there are other first-class hotels to which members can go if they desire; notably, Rennert's and Mount Vernon, both of which are conducted on the European plan.

The details of the programme for the convention have not as yet been entirely determined; however, it can be stated that the convention will be entertained at dinner the second evening of the meeting, and the last day will be devoted to sightseeing. Further details will appear in due course. That we will not famish for want of mental food is evidenced by the following list of essays to be read at the convention:

"Fuel Gas," by Walton Clark.

"Gas Coals of the United States," by H. C. Adams.

"Care and Operation of Gasholders," by C. L. Rowland.

"Water Gas," by F. H. Shelton.

"Leakage and Condensation," by E. C. Jones.

"Purification of Gas from Kansas Coals," by B. E. Chollar.

"Conduct of the Electric Light Business in Connection with the Gas Industry," by W. H. Pearson.

"Advantages of Supplying a Mixture of Coal and Water Gas," by T. G. Lansden.

"Some Thoughts on Fuel Gas, Induced from Practical Experience in the Distribution of Natural Gas," by John Young.

As in years past, I would advise the members to keep these subjects in their minds; to collect such data in relation thereto as they may be able, and to come to the meeting prepared to discuss these themes.

One word as to the question-box. The Secretary frequently hears the statement that the question-box, if properly used, would be the most useful part of our meetings. If this part of the literary programme of our gatherings is not properly conducted the Secretary would be glad to receive advice from the members, and he will do his best to put into practice any suggestions which may be offered. Members have in years past been invited to send in their questions in advance, so that arrangements may be made to have some one prepared to discuss each conundrum propounded. This invitation is again renewed. I would be very glad to have questions for the box sent in as soon as possible, in order that they may be published in the official notices of the meetings—it is hardly necessary, I presume, to add that the names of the questioners will not be published.

In conclusion, I would remind those thinking of joining the Associa-

tion at the coming meeting, that under the new Constitution it is necessary that all applications for membership should be in the hands of the Secretary at least ten days prior to the date of the meeting.

Let us hope that the 17th annual will far surpass its predecessors in the volume of attendance and the importance of its discussions. We have on our roll many names the owners of which seldom appear at our conventions; that the absentees thus miss many pleasant hours, and the companies they serve much useful and valuable information, will, I think, be the unanimous verdict of those who habitually attend our gatherings. Respectfully, C. J. R. Humphreys, Sec'y.

BRIEFLY TOLD.

More about the Baltimore Gathering.—The preparations for the meeting at Baltimore are progressing nicely, and judging from the comments that we have so far heard—which have not by any means been few, either—the paper list, as announced in Secretary Humphrey's circular, seems to have aroused widespread and marked interest. Such being the case, the Association can safely count on a large attendance and satisfactory results. We would, however, again call attention to the necessity that exists for keeping in mind the workings of Section 12 of the Constitution. While no onerous conditions are imposed by the article in question, nevertheless much dissatisfaction might result if proper precaution were not exercised by those who desire to be admitted to membership. Hence it is absolutely necessary that such should keep close watch on the 10-day limit. The Committee of Arrangements, the Baltimore members thereon being Messrs. Frederick Mayer, C. H. Dickey and Frank H. Hambleton, have been and are doing yeomen's work in the instance of preparing for the entertainment of the convention, and we are even at this early day enabled (unofficially, though) to give a fairly good outline of what the pleasuring portion of the gathering is to comprise. On the evening of the second day (October 17) Messrs. Bartlett, Hayward & Company propose to tender to the Association a banquet, the tables for which are to be spread in the main hall of the Concordia Opera House. On the third day it is arranged for that an excursion down the Bay shall be a part of the programme. The route will likely be to Steelton, or some adjoining point, and in the afternoon a visit of inspection will be made to the Bayard street works of the Consolidated Gas Company. We believe that the excursion is to be at the invitation and under the auspices of the Maryland Meter and Manufacturing Company. Baltimore in October is a charming spot, and the outing of the Association ought to be a most pleasurable one; and those who wish to extend the scene of their observations, returning, say, on th Monday evening following the meeting, can readily and profitably do so by going on to the Nation's capital. Washington is but an hour's run from Baltimore, and the train service between the two cities is unsurpassable. By all means, then, every member of the Association who can possibly get away from home should be in attendance at Baltimore on the appointed days in next October.

A Sample from Hamilton, Canada.—We in the States are so familiar with observing odd, not to say corrupt practices in respect to the dealings of public authorities with business corporations, such as the granting of franchises, the awarding of contracts, and so on, that we fear it has become the correct thing not to pay any great attention to these "deals," unless such as are extremely wide of the mark in the matter of fairness. Across the border, however, it was presumed that the constituted authorities gave greater attention to fair dealing; and perhaps they do. Still, our faith in this respect is not so strong as it once was; for we have been recently confronted with reports of actions taken by Town Councils in Canada that are not, in meanness or corruption, a whit behind any ever reported on our side of the border. The most glaring instance, in fact, of municipal "oddity" that it has been our portion to encounter is afforded in the recent action of the authorities of Hamilton, the matter under discussion being the awarding of the contract for the public electric lighting of that city for a term of five years from the first prox. The determination having been reached to light the city by means of 2,000-candle power arcs, the Hamilton Gas Company determined to install the plant necessary for such supply, and accordingly submitted a bid. Under the specifications it was decreed that 250 arcs would be equal to the lighting needs, and that the lights should be kept in service every night and all night. The gas men offered to perform the work on the basis of a charge of 28 cents per night per arc, while the bid of the Hamilton Electric Light Company was put in at 30 cents. These tenders were opened by the Board of Public Works, who in turn handed the same over to the City Council, with the recommendation (all the Board concurring therein) that the bid of the Gas Company be accepted. The Council sent the bids back to the Board, delegating to the latter power to make the award. So far apparently everything was in good faith and stamped with regularity, save that it looked a trifle suspicious that the Council should refuse to act, and that it should delegate its power to a subordinate branch of the local government. The Board, however, seemed to have experienced a sudden and wonderful change of heart A few days before its membership was unanimous in the belief that the Gas Company's bid should be accepted, but without word or warning the Hamilton Electric Light Company was informed that if it would reduce its bid to the Gas Company's figure the contract would be awarded to it. The Gas Company immediately requested permission to withdraw its tender to replace it with a lower one, but the request was promptly denied. The electricians acquiesced in the proposed cut, a tender based thereon was submitted, and the contract was signed. There is no reasonable doubt but that a goodly share of "missionary" work was indulged in. In the meantime, however, this success may not be an unmixed benefit to the Hamilton Electric Light Company, for Mr. Littlehales has been authorized by his Directors to take up the supply of electric lighting, and it may be taken for granted that when this thorough-going gentleman is ready to enter the field, the rates for commercial electric lighting in Hamilton will be somewhat less than those now ruling.

The proposed scheme for foisting a municipal gas plant on the city of St. Louis does not seem to met with favor from the taxpayers. A wealthy resident of that city hus puts his objections to the measure:

"The argument of the promoters of the new scheme for a city gas plant with millions in it—for somebody—is that the city could then furnish gas so cheaply that even the poorest citizen might use it for both heating and lighting. That is a plausible reason with which to catch the popular ear and tickle the popular fancy. But it would have more weight if the condition of things was such as to make it practicable. As a matter of fact, St. Louis has gas at a figure not only reasonable in itself, but exceedingly reasonable for a large city, situated at a great distance from the source of supply of gas-making coal, which is and must continue to be the principal factor in fixing the price of gas, no matter whether made by a city plant or in retorts owned by a private corporation. One other fact should not be lost sight of in this connection, and that is that the making and selling of gas is a business that, like all other businesses, depends for profit more largely upon the number of buyers and the quantity sold than upon the high prices realized. In other words, big sales at a small profit rather than small sales at a high figure is what all gas companies aim at for satisfactory dividends. In this connection it may be said, that the gentleman at the head of the corporation which now controls the gas business of St. Louis is a gas engineer of international reputation, who has a record as a persistent lowerer of the price of gas at every point in the country where he has interests—and they are very many. This, not as a measure of philanthropy, or to curry popular favor, but simply as a means of securing the biggest possible dividends from the largest possible sales. He and his associates have invested a good many millions in St. Louis, foreign money that has been brought to our city in the belief that it would make profits for its investors by giving St. Louis gas at a lower figure than ever before, while harmonizing the clashing of interests that had brought on annoying, not to say ruinous competition between gas producers. The city, it may be remembered, has not been better off in the past with several gas companies than other places have been with only one, properly managed and vigilantly guarded by municipal authority. The pending proposition to put the city in the field as a competitor that will tear up every street in an endeavor to reach customers where it can secure them from existing companies, after having eaten up millions of dollars of taxes and a certainty of absorbing as many more, all without furnishing a better or a cheaper gas than we have at present, is a subject for careful reflection by taxpayers and Councilmen.

"But, aside from the question of competition, which, since it is to affect a corporation—that body which is supposed to have no soul, and hence no feelings—may be regarded as unworthy sentimental consideration, there are certain facts which, in the interest of public economy should be carefully considered by our city authorities before we are committed to an expenditure of millions in a 'blind pool,' to be engineered by men at present unknown, and whose motives may reasonably be supposed the making of money for themselves with the least possible expense and work. Philadelphia is an instance of a large city owning its gas plant as all cities own their water works, and running it under municipal direction. The gas works there are most expensive. They have all the appliances of modern science, and it is but reasonable to suppose command and have the best skilled workmen and gas engineering talent. The affairs of the Philadelphia gas bureau are as well administered as such institutions are likely to be elsewhere. If there is a profit in a city plant it ought to be shown at Philadelphia. What are the facts? Up to a very recent report the works had failed to be self-sustaining by the snug sum of $3,064,256.30! Yet private gas companies all over the country were paying satisfactory dividends. In the item of repairs, for instance, the cost per 1,000 feet of gas sold at Philadelphia was 16½ cents; with a private corporation they were only 2½ cents per 1,000 feet. In 1886 they laid 168,360 feet of small pipe at a cost of $144,660.23. A private company would have laid the same pipe for $98,000. Labor cost Philadelphia 29½ cents per 1,000 feet of gas. Other companies paid only 13 cents. Salaries—always a big item in such an institution owned by a municipality—added to labor, cost 47 cents per 1,000 feet, against 17 cents for the same items elsewhere. This difference alone amounted to $1,050,000 at Philadelphia, a snug little sum, enough for a very comfortable dividend had it been saved."

On the Presence of Sulphur Compounds in Illuminating Mineral Oils.

[Read by Mr. A. Bell at the meeting of the North British Association of Gas Managers.]

The subject of this short paper, which I have the honor of laying before the members of the Association, is one which, although at first sight it may appear to be somewhat foreign to the objects of the Association, is nevertheless intimately connected with the whole gas profession. This is evident from the fact that illuminating mineral oil is the most powerful competitor gas has to contend with, both amongst the poorer classes, to whom its low price recommends it, and amongst the upper classes, who, under the belief that illuminating mineral oils do not give off deleterious compounds during combustion, have to a large extent adopted oil in preference to gas in their drawing-rooms, libraries, etc.

Although the fact that sulphur compounds do exist in illuminating mineral oils has been known to many engaged in the kindred manufactures of oil and gas, still this knowledge has been of a very vague and indefinite character; while by the great majority it has been all along taken for granted that illuminating mineral oils are entirely free from sulphur compounds. And even those who are aware of the existence of these compounds have never yet, so far as I know, compared the relative amounts of sulphurous gases respectively produced during the combustion of coal gas and mineral oil.

In the hope that the subject may prove of interest to the members of this Association, and that it may be the means of dispelling the mistaken idea that illuminating mineral oils are free from sulphur compounds, I have prepared this paper, which gives an account of a number of experiments made upon mineral oil, in which experiments I have been engaged for some time past.

Before proceeding to enumerate the results of the various experiments I have made, I should like to say a few words in explanation of how I was led to take up this subject. Some months ago, at the suggestion of Mr. William Young, I entered into a course of experiments with regard to the purification of coal gas from sulphur compounds, other than sulphureted hydrogen, by means of liquid hydrocarbons. This same subject, as will be known to most of you, formed part of an elaborate and instructive paper read by Mr. Young before this Association at Stirling two years ago, when I also enjoyed the privilege of assisting him. The method which I adopted in the process of carrying out the above-mentioned experiments was, in the first place, to ascertain, by means of the well-known Referees' Sulphur Testing Apparatus, the amount of sulphur other than sulphureted hydrogen which was present in the gas supplied to the town of Peebles. The result of a large number of daily tests showed that the gas contained a quantity of sulphur varying from 10 to 15 grains per 100 cubic feet. My next step was to pass the gas through an experimental purifier filled with sawdust which had been previously saturated with various liquid hydrocarbons, and then to ascertain the effect of this purification by again estimating the amount of sulphur in the gas.

I may here mention that these experiments are not sufficiently far advanced to allow me to state anything definite regarding the purification of coal gas from sulphur compounds by means of liquid hydrocarbons, but I hope that I may have the pleasure of laying a paper on this subject before you at some future date. In the meantime, I shall confine my remarks to that part of the experiments which led me to investigate the subject of this paper.

One of the liquid hydrocarbons used in these experiments was paraffin spirit, which, as you are aware, is recovered from the waste gases produced during the distillation of shale. This spirit is extremely volatile, and possesses a powerfully solvent affinity for the sulphur compounds in coal gas, as well as for some of the hydrocarbon vapors with which these compounds are associated. From the nature of this spirit, I expected that a certain reaction would follow, viz., that, while the gas was being passed through the sawdust saturated with spirit, the spirit would take up into solution some of the sulphur compounds, together with some of the hydrocarbon vapors, out of the gas; and the gas, in its turn, would take up into diffusion some of the more volatile portions of the spirit.

To what extent the sulphur compounds were absorbed out of the gas by this particular sample of spirit I have not yet investigated; but that the gas did take into diffusion some of the more volatile portions of the spirit was evident from the fact that the amount of sulphur present in the gas, after its passing through the purifier, was equal to 35 grains per 100 cubic feet, or 2½ times the amount it originally contained. Believing, as I did, that paraffin spirit, and, in fact, that all paraffin oils were practically pure hydrocarbons, I was for some time at a loss how to explain this apparent anomaly; and it was only after a quantity of the spirit had been consumed in an oil lamp, which I substituted for the Bunsen burner in the sulphur-testing apparatus, that it was found to contain an amount of sulphur in combination equal to 0.217 per cent., or in other words, 112 grains per gallon. Upon making inquiry I ascertained that this sample of spirit was only partially refined, as it was simply intended for use in vapor lamps to illuminate ship-building yards and other open spaces; it would, therefore, require to be further refined before it could be applied to the purification of coal gas from sulphur compounds.

At this stage of my experiments my attention was drawn to what forms the subject of this paper. From my previous connection with the oil trade, and my acquaintance with the methods practised in the refining of paraffin oils, I was led to infer that possibly illuminating mineral oils might also contain sulphur compounds. I was aware, too, that the principal constituents of both paraffin spirit and paraffin oil are members of the same series of hydrocarbon compounds, and that their treatment in the process of refining is substantially the same. These facts went far to strengthen my inference, while a rough test with a sample of paraffin oil I happened to have on hand established it. I found that the oil did contain sulphur compounds.

Being, therefore, satisfied regarding the presence of sulphur compounds in illuminating paraffin oils, I was naturally anxious to ascertain the extent to which they existed in the various oils used throughout the country. I accordingly obtained typical samples of the principal oils manufactured in this country, and also some samples of petroleum oil, which I tested in the following manner:

From each sample of oil a quantity weighing about 2,000 grains was taken and slowly consumed in the presence of ammonia, the products of combustion being, at the same time, condensed and collected. The liquor thus obtained was then treated with hydrochloric acid, and the sulphur contained in it precipitated by means of chloride of barium and weighed as sulphate of baryta.

While tabulating the results of these experiments I found, that, although the correct method of doing so was to state the amount of sulphur in percentages, these percentages would not convey a clear idea of the extent to which the sulphur existed in the oils, owing to the fact that it is customary in the gas trade to state the quantity of sulphur in gas as grains per 100 cubic feet. And, further, when we consider that mineral oils and coal gas are both used as illuminating agents, it is but proper that the deleterious compounds respectively produced during the combustion of these illuminants should be compared with equal amounts of illuminating power. Therefore, in order to obtain a direct comparison between the amount of sulphur in oil and that in gas, it was necessary to determine the relative illuminating value of mineral oil and coal gas. This relative value has been from time to time determined by many eminent chemists while engaged in estimating the comparative cost of oil and gas lighting; and in every case they have compared the cost of equal amounts of illuminating power. As the experiments made by these chemists for the purpose of determining this relative value were conducted on a much more extensive scale than the means at my disposal would permit me to do, I considered it unnecessary to experiment in that direction, contenting myself with the average of the results given by a number of these chemists, which results, together with the names of their respective authorities, are given in the following list. The results are stated as grains of oil equivalent to 1-candle power per hour:

Dr. Letheby	37.20	grains.
Captain Webber and Mr. Rowden	58.00	"
Herr von Heim, Hanover	51.00	"
A member of Societe Technique de l'Industrie du Gaz en France	45.70	"
Mr. Lewis T. Wright	39.00	"
Mr. J. T. Lewis	44.62	"
Mr. T. W. Hartley	58.58	"

The variations in these results are probably due to the differences in the constitution of the several oils experimented with.

The average of all these results is 47.73 grains. Having now obtained the weight of oil which is equivalent to 1-candle power per hour, we have only to multiply this by the candle power per hour of 100 cubic feet of gas and by the percentage of sulphur in the oil, and the product will show the number of grains of sulphur contained in a quantity of oil which, during its combustion, would give an amount of light equal to that from 100 cubic feet of gas.

The following table shows the results of my experiments with the various oils. When extending these results I adopted both Scotch gas (28 candles) and English gas (16 candles) as standards for comparison. I should here mention that, for obvious reasons, I have refrained from giving the names of the various oils tested:

Paraffin Oils.

Sample of Oil.		Oil Consumed.	Sulphur Obtained.		Grains of Sulphur in Oil Equal to 100 cu. ft. of Gas.	
Ref'rence Letter.	Sp. Gravity	Grains.	Grains.	Per Cent.	28-Candle.	16-Candle.
A.....	.804	1,738	2,609	.150	40.0	22.9
B.....	.806	2,290	1,771	.077	20.5	11.7
C.....	.812	2,311	5,232	.226	60.4	34.5
D.....	.806	1,829	3,254	.177	47.3	27.0
E.....	.806	2,020	4,422	.218	58.2	33.2
F.....	.809	1,400	3,131	.223	59.6	34.0
G.....	.806	2,374	3,694	.155	41.4	23.6
H.....	.807	2,272	3,927	.172	45.9	26.2
I.....	.808	2,104	3,309	.157	41.9	23.9
K.....	.810	2,105	2,746	.130	34.7	19.8
L.....	.804	2,225	4,518	.203	54.2	31.0
M.....	.809	1,166	1,812	.155	41.4	23.6

Petroleum Oils.

A.....	.787	2,025	.329	.0162	4.3	2.4
B.....	.801	2,034	4.903	.2410	64.4	36.8
C.....	.788	2,311	.370	.0160	4.2	2.4

Contrary to what has been the general belief, these experiments clearly show that paraffin and petroleum oils *do* contain sulphur compounds; and that, when they are compared light for light with coal gas, they give off during combustion an amount of sulphur far in excess of that from coal gas.

Some further experiments which I have made indicate that the sulphur compounds present in mineral oils, like those in coal gas, are, during combustion, liberated into the atmosphere in the form of sulphurous acid. Keeping this in mind, we cannot do otherwise than consider it extremely improbable that the sulphurous gases in the products of combustion from coal gas are more injurious than the same gases in the products of combustion from mineral oil.

I would only say, in concluding, that my object in bringing this matter before the Association will be fully served if I have supplied its members with any data which will enable them to combat the popular, but mistaken belief that mineral oil is a more healthy and less noxious illuminant than coal gas.

Steam Boiler Trials.

The Complete Combustion Company, of 34 Oliver street, Boston, has recently made some trials of a new type of boiler, located at Smith & Carlton's iron works, in South Boston. These trials, of which there were two, were conducted by General Reynolds, of New York, and Francis E. Galloupe, Mechanical Engineer of this city, and may prove of interest to those engaged in the supply of electric light and power, as well as to all other steam users.

It should be premised that the season was unfavorable for high results in evaporating tests, owing to weather conditions and the difficulty in securing the necessary draught. Nevertheless, the figures given below show a better performance than is usual with steam boilers.

Briefly described, the boiler has an internal furnace, entirely surrounded by water-tight surfaces. The boiler tested was of the horizontal type, with shells 6 inches in diameter and 13 feet 11 inches long over all. The tubes number 168, 3 inches outside diameter, 6 feet long. The furnace is 5 feet 4 inches wide, and 4 feet 6 inches long, and contains the grate, which is made of extra thick, 1¼-inch tubes, and connects with a water leg extending downward from the crown sheet, near the back end of the furnace, and enters a gun-metal box in front. Return tubes from the box, 2 inches in diameter, carry the water back to the water leg, thus securing free and rapid circulation of water through the grate at all times. To further aid the circulation these tubes are all inclined from the horizontal, the grate tubes 1 inch to 1 foot, and the return tubes 1½ inches to 1 foot. The number of grate tubes is 27, and of return tubes, 8, with ⅝-inch spaces between the grate bars.

The grate is 5 feet 4 inches wide, and 4 feet 6 inches long, and has an area of 24 square feet, area in throat to tube chamber, 4.38 square feet, and through tubes, 8.25 square feet.

The chimney is brick for 10 feet, topped by an iron stack, 70 feet high. Its diameter is 2 feet 6 inches, and area, 4.90 square feet.

The areas of the heating surfaces are: in grate, 78 square feet; in furnace, 155 square feet; in tubes, 791 square feet; total heating surface, 1,024 square feet, and heating surface per square foot of grate area, 42.66 square feet.

The peculiarity of this boiler consists in the downward draught, the fire being drawn by the chimney draught downward through the grate bars into a combustion chamber below, which takes the place of the ordinary ashpit. The course of the hot gases is then upward, through a space 18 inches wide, back of the water leg, to the tubes, thence to the uptake in the chimney. The fire doors are always kept open for the admission of fresh air, the combustion chamber doors being always closed, even when firing, thus avoiding the cooling of the boiler at these times.

The condition of the boiler was new and clean, and the tests show some new and interesting variations due to changes made in the chimney after the first trial.

On the first trial, July 23d, the height of the chimney was 60 feet above the grate bars, and a conical hood over its top greatly obstructed the draught. On the second trial, July 30, this hood was removed and the chimney lengthened 20 feet, the result being to burn the coal with greater completeness, as shown by lower percentage of refuse, 16.46, as compared with 18.40.

Other features of these tests will be seen by comparisons of the appended results which cannot but be regarded as excellent:

Results.

	July 23.	July 30.
Steam pressure by gauge, average	76	77
Temperature, in flue, average	385°	398°
" boiler room, average	82°	94°
" outside, average	75°	81°
" feed water, average	158°	164°
Weight of kindling wood, lbs	162	161
" " " (at 4) coal	65	64
" coal	2673	2800
Moisture in coal	1¼	Dry.
Weight of total equivalent amount of dry Cumberland coal consumed	2738	——
Dry coal consumed, total	2705	2864
Weight of refuse, total	486	461
" " percentage of net coal	18.40	16.46
" of total combustible consumed	2219	2403
" of dry coal consumed per hour	270	286
Weight of dry coal consumed per square ft. grate per hour	11.25	11.92

Water.

Weight actually fed and evaporated	24200	26926
Equivalent water evaporated into dry steam, from and at 212° F.	26400	29213

Economic Evaporation.

Water per lb. of dry coal, from actual pressure and temperature of feed	8.95	9.40
Equivalent evaporation per lb. dry coal, from and at 212° F.	9.76	10.20
Equivalent evaporation per lb. combustible, from and at 212°	11.97	12.21

Commercial Evaporation.

Equivalent water evaporated per lb. of dry coal, with one-sixth refuse, at 70 lbs. gauge pressure, from 100° temperature	8.68	8.85

Rate of Evaporation.

Water evaporated from and at 212° F., per square foot heating surface per hour	2.58	2.85

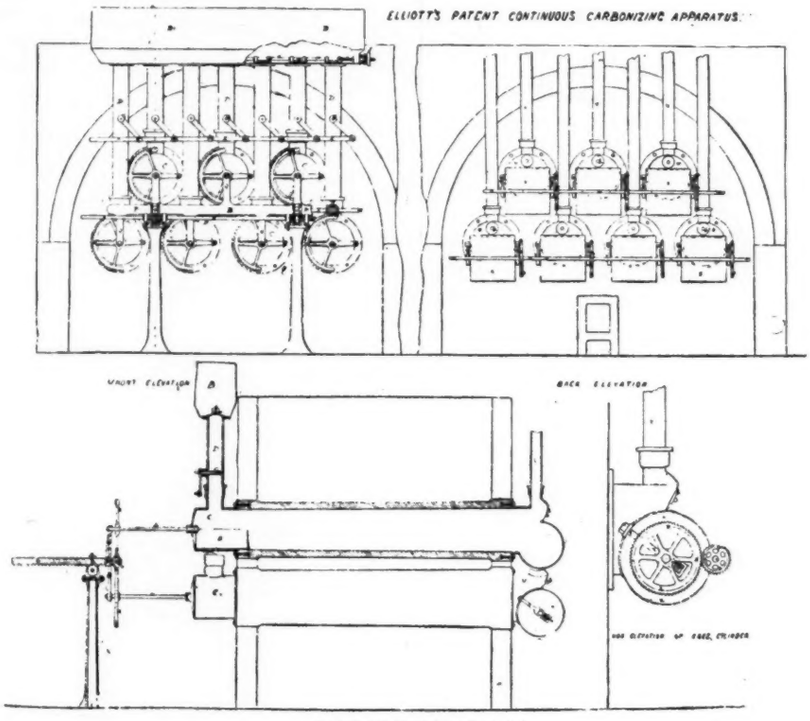
Commercial Horse Power.

At 30 lbs. water evaporated from 100° F. into steam at 70 lbs. gauge pressure, horse power developed	76.52	84.67
Horse power, builder's rating	75	75
Per cent. developed above rating	2.03	12.90

Elliot's Improvements in Gas Apparatus for Effecting the Continuous Carbonization of Coal.

This invention (which is the subject of a recent patent) has for its object the construction of apparatus whereby the carbonization of coal for the production of gas may be made continuously, and without opening the front of the retort at short intervals for the insertion of coal and the withdrawal of coke. The apparatus consists of an ordinary retort *A*, or it may be made larger at the outlet end to allow the expansion of the coal during the process of carbonization. A hopper *B* is attached for containing a quantity of coal, the hopper being connected to the mouthpiece *C* by a pipe *D*. This pipe is provided with an arrangement for preventing the escape of gas while coal is being let into the scoop, or charger, *E*, inserted in the mouthpiece. This arrangement consists of a gas-tight cover *F* working on a true surface fixed on the bottom of the hopper, and a coal regulator *G* made to turn loosely in pipe *D*. The covers *F F* are connected by means of a rod *H*, so that on turning the wheel *J* they open or close the pipe *D D* altogether, or they may be moved by a lever. The regulators *G G*, which only require a quarter of a turn to open on full, may be turned separately by means of levers, or may be turned together by connecting the levers to a rod *K*. The scoop *E* is fixed to a rod *L* passing through the lid of the retort, and having a semicircular toothed wheel *M* attached to the other end. The toothed wheels are geared to worm wheels *R R* fixed to the shafting *S*. Each scoop may be driven into or drawn out of the retort by separate thrusts or pulls of the hands, or the whole of the scoops may be thrust in or withdrawn by turning the shaft *N*, which gives motion to the racks *O O*; these racks are connected to a crossbar *P* having as many arms *Q* as there are retorts in a setting. Each scoop rod *L* passes through a hole near the extremity of its respective arm, so that on the shaft *N* being made to revolve the crossbar will either advance or recede, and the rods, and consequently the scoops, will be either thrust in or drawn out of the retort by the pressure of the arms. To the opposite or back end of retort there is also a kind of mouthpiece *U*, which, for the sake of distinction, may be called the "tailpiece," and from which the ascension pipe *V* rises. The tailpiece is provided with a hand hole *D* for cleaning the said ascension. The tailpiece has an opening *W*, which corresponds with an opening in a short cylinder *X*, that is pivoted to arms *Y Y* attached to the tailpiece. The one side of the tailpiece is made with a true semicircular curve, so that when the cylinder *X* is brought up against it the cylinder may turn, though in close contact with the facings of the tailpiece, and insure a gas-tight joint. The opening in the cylinder may be exposed for the discharge of coke by a handle attached to the axle of the cylinder, or the whole may be actuated by means of toothed wheels *B B* fixed to the shaft *A*, and geared into other toothed wheels *Z Z* attached to the cylinder. The bearings of the cylinders are supported by springs *C C*, which keep the cylinder in close contact with the tailpiece.

The action of the apparatus is simple, and is as follows: The hopper being charged with coal, the covers *F F* are drawn from the tops of the pipes *D D*: the coal then falls till it fills the space between *F* and *G* (which when full contains a fixed quantity of coal). The covers are returned till they close the openings, the regulators *G G* are opened, whereupon the coal will fall into the scoops below. The rod is then thrust in to its full length by the operation of the racks and pinions, and turned over by revolving the shafts, or they may be turned separately by levers. The coal will thus be deposited on the bottom of the retort ready for carbonizing. The rods are then drawn out and the scoops returned to their former position. When sufficient time has elapsed the scoops are again charged with coal and thrust forward and turned over. In thrusting forward the second charge of coal, the coal already introduced, which by this time has been partly carbonized, will be pushed toward the opposite end of the retort, and by repeating the operation the coal which has been converted into coke will fall through the opening in the tailpiece into the cylinder. This cylinder, on being partly turned at intervals by means previously described, will allow the coke to fall out of the opening in it into a barrow or other convenient receptacle. The cylinder is then returned to its former position, where it remains until sufficiently charged with coke to make it desirable to discharge it, whereupon the cylinder is made to turn over until the opening is fully exposed, when the coke will fall out as before. By these means carbonization may be carried on continuously, and the work of the stoking house is practically reduced to machine attendants only.



SECTION THROUGH A A.

Fireproofing Mediums.

Victor Laporte, writing on this subject, says that the materials used for buildings possess widely varying properties, as far as their inclination to burn is concerned. It is obvious that a building, the bulk of which essentially consists of iron, need not fear to suffer half as much in a conflagration as another entirely constructed of wood, although no building is entirely secure, as was shown by the destruction by fire of the Crystal Palace in London. For this reason endeavors have been made

to produce material which is entirely incombustible, and may safely defy the ravages of fire. This question is certainly one of the most prominent among those pertaining to the public security, and of all others deserves the first place among the plans relating to both public and private hygiene. In this connection it is worth while to state that the nations of Europe sometimes permit themselves to be excelled by the inhabitants of countries generally considered as non-progressive in matters of culture; for instance, as China and Japan. Indeed, a professors' chair for hygiene, in all its relations to architecture and the technical arts, has recently been founded in Japan, and, doubtless, the question of conflagration will be an important subject for the chair.

There are two ways of rendering a domicile incombustible:

First—By the use of completely incombustible building material.

Second—The ordinarily combustible substances are furnished with protective coverings to make them incombustible. It is the purpose of this article to cursorily review the different substances, coatings and fabrics, invented and proposed.

Asbestos is the first material which suggests itself at once whenever a textile fabric, which will completely resist the influence of fires, is to be mentioned. It is known that the ancients used table-cloths and other woven fabrics which, when to be cleaned, were thrown into the fire; they also used lamp-wicks made from asbestos, which, of course, were not consumed. Its principal use was for winding sheets, in which the corpses to be cremated were wrapped.

Asbestos, which is also known as arnianthus, and by a number of local names is a silicate of magnesia, and frequently contains water. It is found as a white, green or gray mineral, of a fibrous, felted, supple and silky texture: from a mineral point of view, it is closely related to hornblende and augite; it is principally found in the fissures of serpentine rock. It is found in many places of the earth. Asbestos can be spun and woven, and be manufactured into paper, knitted and textile wares. The facts that, comparatively, it is somewhat scarce, and that its fibers break in the operation of weaving, cause the stuffs manufactured therefrom to rule fairly high in price. The firemen of various localities in France have clothes made of it.

Painting buildings with asbestos has become customary in London, and the fire insurance companies of that city have lowered the premiums one-half on structures so treated. Experiments made in the Champs de Mars, Paris, in trying to burn houses painted with it have shown that it is eminently useful for this purpose.

By the employment of asbestos, Nagel has produced an entirely incombustible pasteboard in the following manner: A thin paste is made from 200 parts of oxide of zinc and 100 parts pulverized asbestos; this is spread out upon a metallic web. The mass is rolled, and after drying the plate is saturated with a strong solution of chloride of zinc, after which it is passed through the rollers another time. By this treatment oxychloride of zinc is produced. The moisture causes the formation of a little rust upon the iron wire, by reason of which the substance adheres firmly. The plate is again dried, and another time saturated with chloride of zinc; the whole is left in this state so that oxychloride can form, after which the plate is immersed in water for one or two days, whereby all the acid is removed. The plate is then washed, and thereby receives its desired flexibility. Such plates, manufactured in this manner, will absorb water, but may be made impermeable by saturating them with a silicate and caseine. By grinding the surface they can be made very smooth.

These plates may also be prepared in another manner. Nagel has, for instance, replaced the chloride of zinc by other metallic chlorides and sulphate of alumina. In place of the oxide of zinc, magnesia, lime and gypsum may be used. For the covering of roofs, plates of the last-named composition have been made impermeable by an addition of soap, whereby an insoluble combination of the fatty acids with lime and alumina is formed. Plates prepared according to Nagel's formula will protect wood against danger of injury by fire, as was proven by the following experiment. A box 6 centimeters (2.36 inches) long, 4 cm. (1.58 inches) broad, and 3 cm. high, and only 1.25 millimeters (0.20 inch) thick, made of plates of this kind, was placed for five minutes between the flames of two Bunsen burners without any damage; a paper inclosed within had not even turned brown.

Asbestos is also a constituent of a colored coating prepared by Wendt and Herard; its composition is as follows:

Color (oxide of lead, copper, or manganese	15 parts
Linseed oil	12 "
Silicate of soda	50 "
Asbestos, talc and raoline	15 "
Water	8 "

These inventors have also indicated the following two compositions which contain no asbestos:

1.—Water	75.25 parts
Sal. ammonia	8.00 "
Hyposulphite of soda	2.25 "
Sulphate of ammonia	10.00 "
Borax	4.50 "
2.—Water	70.5 "
Hyposulphite of soda	2.5 "
Sulphate of potash	10.0 "
Borax	5.0 "
Alum	12.0 "

The latter preparation is by them recommended for the saturation of wood.

Rabitz has specified the following method of rendering walls and ceilings fireproof. A tightly stretched metallic web is plastered upon one side with a mixture of gypsum, lime and coarse sand, and cow's hair. For the walls make the plates 40.50 millimeters (from 1½ to 2 inches) thick; for ceiling from 30 to 35 mm. (1.18 to 1.38 inches) thick; for vaults from 50 to 75 mm. (2 to 3 inches) thick. The walls will be dry in the course of a few days, after which they may either be painted or papered. The plastering, the composition of which was just now given, may also be replaced by a waterproof cement. Rabitz's method possesses a triple advantage; it protects against fire, moisture and tremblings of the earth.

The following coating for textile fabric, wood and paper is recommended as being incombustible: Boil holly wood for one hour in a solution of table salt; to this add sulphate of zinc, sal ammoniac and alum. The mixture must be for four hours heated over a gentle fire; then add whalebone and stir so as to incorporate very intimately; the fluid is thereupon passed through a fine sieve. When to be used, it is applied with a brush to the object to be protected. Two coats are sufficient for paper or textile fabrics. Evaporation of this fluid when stored can be prevented by pouring upon it a thin coat of gelatine solution.

A water glass solution can be prepared and used in the following manner: Melt in a crucible 15 parts quartz or very clean sand, 10 parts purified commercial potash and one part charcoal, these several ingredients to be in a powdered state. When the mixture runs steady, pour. The solidified glass is powdered and dissolved in four to five-fold its weight of boiling water. The solution may be applied with a painter's brush; it dries rapidly, and the coating keeps without change.

Painting with caseine colors, which is for the purpose of producing fireproof coatings, is done in the following manner: Stir together 3 parts fresh curds and 1 part slaked fat lime. For pigments add earthy or metallic oxides (peroxide of iron for light red to deep brown, ultramarine or cobalt for blue, oxide of zinc or baryta white for white, bone black for black), but no organic dyestuff, like aniline colors. White lead, Prussian blue, cinnabar and ochre are also unsuitable, as they first lose their color and then turn black. This mass, the caseine lime, must be prepared on the day on which it is to be used and the brushes must be cleaned each time after using. Painting with caseine paints is good for both woodwork and masonry.

A solution of table salt and alum, or water glass and carbonate of soda, may also be used as a fireproof paint. The aqua ammonia of gas houses diluted with water also possesses fine quenching properties. This fluid is objectionable, however, on account of the suffocating gases it evolves.

Guide-Framing of Gasholders.

The London *Journal*, in reporting the leading features of an English patent (No. 11,960, Aug. 18, 1888), granted to S. Cutler, of Milwall, says that the same has for its object the construction of the guide-framing of gasholders in such a manner that it shall possess great rigidity and strength to the various strains each part may have to bear.

The patentee proposes to make the framing in one of two ways analogous to each other. According to the first arrangement the framing is made concentric to the gasholder, and of two or more series *A* and *B* (Fig. 1), of wrought iron, steel, or other suitable metal girders, crossing and being fixed to each other at the points of intersection *C*. Each line of each series of girders is curved so as to partly encircle the gasholder, and in so doing to form a portion of a spiral; the broad surface of the girder (as shown at *D*) being placed diagonally to the horizon—the whole forming a cylindrical network of girders.

In the second arrangement (as Fig. 2), instead of making the arrange-

ment circular in plan it is made polygonal, which, having regard to economy of manufacture, will (says the patentee) in many cases be preferable; each side of the polygon being formed of two or more series of straight girders *E*, placed diagonally to the horizon, with vertical girders *F* at suitable intervals.

Fig. 1.

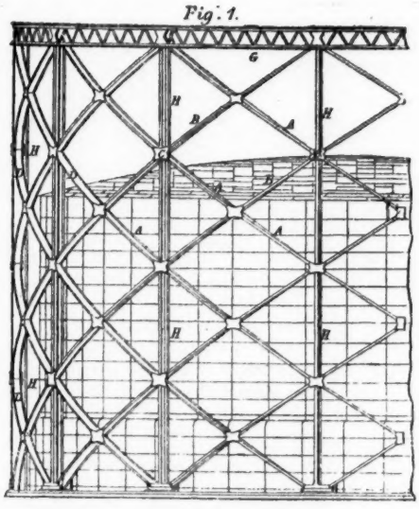
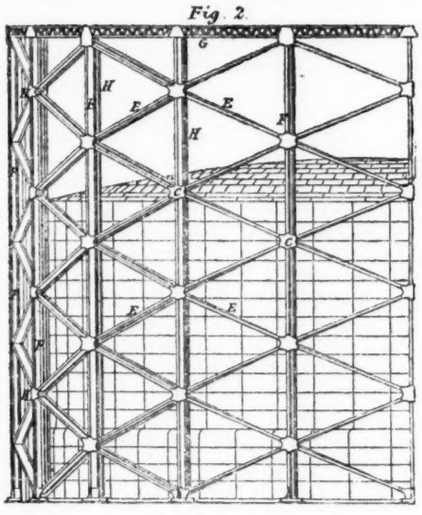


Fig. 2.



In both arrangements the end of each line of girders is fixed at top to a special girder or girders *G*, preferably of box form, while the lower ends of the girders are fastened by holding-down bolts either to the tanks, piers, or other bases; or they may be secured to a girder of a similar character to that at the top, so that the holding-down bolts can be placed at more frequent intervals, and thus distribute the strain over the tank or other foundations.

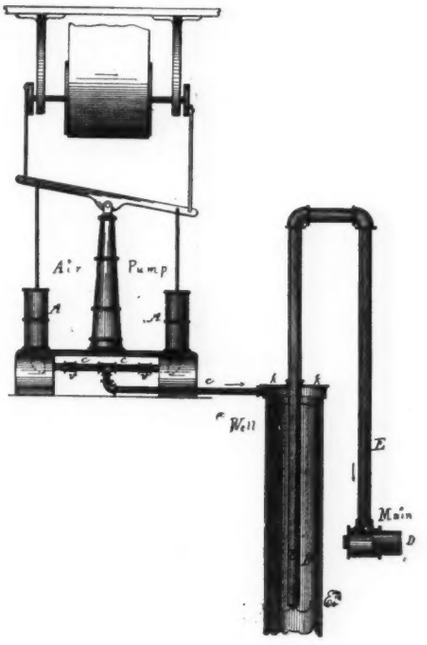
The guides *H*, for the rollers of the gasholder, in both cases are fixed vertically to the top, bottom, and intermediate girders; and they are in some cases constructed so as to form part of the network of girders already described; but, though advantageous, this connected construction is not essential.

Method of Accelerating the Flow from Natural Gas Wells.

Erwin A. Cook, of McComb, Ohio, having, in common with others, noted the existence throughout the natural gas regions of wells whose pressure was insufficient to cause them to be of any important commercial value, turned his attention to the developing of a process or method whereby the flow from such wells could be accelerated. The result of his attempts is given below, and the device is covered by Letters Patent No. 408,652.

In his specification the inventor claims protection for a process for "increasing the fuel and illuminating capacity of natural gas from gas wells, which consists of injecting air into said wells in sufficient quantities to make it intermix with the natural gas therein and impart to said gas sufficient pressure and volume to cause the same to flow readily from the well."

Referring to the illustration, at *A* is shown an air-pump, which is operated by motive power in any suitable manner. The currents of air



are generated in the pump and injected into the gas well *B* through the pipes *C*. The pipes *C* are constructed in any suitable form, and located in them (near said pumps) are two check-valves *u*, for the purpose of preventing the air from re-entering ths pump cylinders. The mouth of the well *B* is sealed and capped by means of the casing head *k*.

The inventor insists that under this plan when the air is thus injected into the air-tight well it will properly intermix with the gas, causing the latter to expand, and imparting to it volume and force sufficient to force it out through the exit *F*, thence into the main *D*. The claim is made that the application of this method will certainly quadruple the force flow of any existing light pressured well.

Concrete Floors.

By Frank Caws, in London *Builder*.

The strength of Portland cement varies greatly. All other things being equal, the finest-ground and heaviest is the best. The strength varies, not only from quality of material, but also, and very greatly, from age when used. The older the better, provided the old has been kept in a dry atmosphere. New cement is too hot and strong for immediate use. It sets more rapidly, and expands more, than old cement, and the result is an irregular and less reliable one. The maximum strength of a briquette of old cement is maintained, while that of a briquette of new cement is found to "go back," as the manufacturers phrase it.

Not only do the quality, fineness, and age of cement when used affect its ultimate strength, but also the mode of use largely governs the result. Thus, for example, the less the water used (all other things being equal), the stronger the product. And again, if the briquette be made under heavy pressure, it proves much stronger than if made with minimum pressure.

The time in which the setting is accomplished, and in which the maximum strength is attained, varies greatly. The best cements mature most slowly. Large masses set more slowly than small masses. Masses whose surface area is large in proportion to their volume set in air more rapidly than masses whose surface area is small in proportion to volume. Masses under pressure set more rapidly than masses not under pressure. Thus the brick beds and joints of a piece of underpinning, built in cement, set as fast as built, and expand so as to neutralize the effect of pressure from the superimposed weight; but thick masses of concrete in floors and walls take a much longer time to set. For underpinning work, where quick setting is needed, new cement answers quite as well, if not better, than old; but for floors the case is different.

Architects can easily specify old cement for their concrete floors, but they cannot easily get it. Generally the demand for cement is so heavy that manufacturers do not keep much old in store, except for purposes of seasoning the new.

The best way to obtain really old cement is to make a special compact with a first-class manufacturer, that his cement shall be specified, on the sole condition of his putting by a separate heap for the exclusive use of this particular contract. If the quantity of cement required be considerable—say 50 to 100 tons—it is worth the manufacturer's while to make such an arrangement; and, provided he has three months' full notice, he can generally honorably fulfil his promise. Having thus done his best to secure for his client the best cement in the market, the architect will now be well advised to make his calculations for strength on the assumption that he is getting, if not the worst cement obtainable, still a quality barely up to the average.

A briquette of matured strength and fairly good cement will stand a tensional stress up to 500 lbs. per inch. Briquettes of one month old will break at a tension ranging from about 250 lbs. up to about 450 lbs. per inch, according to the quality of cement, quantity of water, and mode of mixture, etc.; also according to the mean temperature during the month of setting. Briquettes mature more rapidly than thick floor slabs. Many contractors for concrete floors carelessly remove the centering within one week, two weeks, and three weeks of setting. And, as a result, the floors are often permanently injured or weakened, visibly or invisibly, though seldom are they ruined and destroyed by it, for it takes more than common measure of folly to squander all the huge hoard of strength of a concrete slab.

In calculating strengths, the architect should reckon only on an ultimate tenacity of neat cement of 250 lbs. per square inch; though in all probability his best cement at twelve months old would, if mixed under best conditions, realize an ultimate tenacity of something like 1,000 lbs. per inch. And in no case should the centers be removed in less than five weeks; and if they can be maintained much longer, so much the better, for special reasons which will hereinafter appear.

When brickwork, which has been built in fairly good Portland cement, is pulled down, builders find it impossible to clean the bricks for re-use. The cement cleaves so fast that it cannot be separated from the brick. This fact shows why in estimating the strength of concrete composed of cement and broken brick aggregate, the quality of the aggregate is so great a consideration. There is a marvellous difference between the tensile strength of good, hard, well-burnt bricks, and of soft, ordinary stocks. No bricks, however, are so strong as cement. The best obtainable broken brick suitable for concrete aggregate probably possesses about one-fourth the strength of best cement; or for one-fourth to one-third, both tensionally and compressively. And for practical calculations it will be wise to treat the aggregate as possessing only one-fifth the strength of neat cement. When the aggregate and cement are combined, as in concrete, the strength of the concrete will depend, to a considerable degree, on the proportion of the two ingredients.

For concrete floors, the cement should be not less than one of cement to four of aggregate. The cencrete in this case will possess a strength of about two-fifths of neat cement; but, for practical calculations, it is safer to consider the concrete of this proportion of admixture equal to quarter strength of cement.

Just as in iron beams the greatest stress occurs in the flanges, and the webs are in comparatively little stress; so in concrete floors the material nearest the surface is in greatest stress, the top surface being in compression, and the bottom in tension. Thus, if concrete floors were cast in hollow homogeneous slabs, the vertical divisions connecting the top and bottom layers would have comparatively little stress to bear. Hollow floors of this sort cannot well be formed at small cost. But the same allowance for disposition of stress can be made in another way, viz., by first laying a thickness next to the centering; then, before that is fairly set, following upon it with an intermediate thickness; and, finally, finishing with a top thickness. Just as the flanges of a well proportioned girder are very thin in comparison with the girder's total depth, so the first and last layers of concrete may be very thin in proportion to the total thickness of the slab. And what the narrowness of the web is to the girder, that the smallness of proportion of cement to aggregate in the central layer will be to the slab.

Instead, then, of mixing the whole thickness of slab one of cement to four of aggregate, a much stronger result will be obtained by making the bottom layer and top layer each about one-sixth the total thickness, and composed of one and a quarter of cement to two of fine crushed brick; and making the central four-sixths of concrete thickness, composed of one of cement to six of ordinary broken brick aggregate. In this case the cement still forms one-fifth of the dry bulk of cement and aggregate; but the cement, as will be understood, is disposed to better advantage. The bottom and middle layer should always be done in one day, and the top layer should be done on the following morning, or as soon after as to secure perfect homogeneity.

In ordinary cases, no such disposition of the cement in *flanges*, so to speak, is *intentionally* performed. But, fortunately for the strength of floor slabs, where no fine bottom layer is separately and purposely laid as above recommended, the cement is deposited by gravity in much greater quantity next the ceiling level than at higher levels of the thickness; so forming, as it were, its own natural flange. Indeed, so remarkable is this sediment of the cement to the bottom of the slab thickness, that the most perfect impression of the board centering is always obtained on the under surface; even the grain of the wood being so minutely reproduced as to deceive the eye into thinking the ceiling is really composed of boards, when the board centering has been entirely removed.

The joints of the wood centering act as a seive, and allow superfluous water to drip through. This is not desirable, because it not only drains away the cement with the water, but also introduces streams of motion in the concrete during the time of its setting, when it ought to be perfectly undisturbed.

An excellent method has lately been adopted for preventing this dripping and disturbance, and, at the same time, for securing a perfectly finished, smooth, fair ceiling of solid concrete, instead of the usual plaster skimming coat, which is liable to fall off, because the cement is so dense it affords very little key or suction.

The improved method is as follows: Before the concrete is cast, the centering is coated with a thin skin of plaster of paris floated up perfectly level and fair. Upon this plaster surface a grout of pure cement and water is thinly spread, and upon this grout the concrete proper is cast, and beaten down in the usual manner. The skin of plaster of paris is perfectly water-tight. Not a drop passes through it, and thus the concrete sets more slowly, and to better purpose; and when the centering is eventually removed, the plaster comes away with it, and leaves concrete solid ceiling smooth and fair, without a blemish or defect to mar its continuity of surface.

It is of the utmost importance to set the uprights which sustain the weight of centering upon very sharp wedges of soft wood. The softness of the wood of these wedges admits of an infinitesimal deflection or yielding under weight, which is a useful relief to excessive stress, and, by slowly relieving the supports by means of the gradual loosening of these sharp wedges, the builder avoids that sudden *jar* of stress which tends, when centers are too suddenly removed, to damage the slab floor much more severely than years of heavy wear and tear. It is impossible to over-estimate the importance of this matter, for it is absolutely certain that, when the weight of the floors is transferred from the centering to the haunches, or edges or skewback abutments of the floors, an infinitesimal, but none the less real, deflection of the center of every slab *must* occur, and the almost utterly inflexible nature of the cement concrete slab renders it absolutely imperative that this transference and its unavoidable set or sag shall be accomplished with the utmost practicable slowness and avoidance of momentum.

The damage done to a slab by neglect of this precaution in removing centers is seldom, if ever, detected immediately. But the weakness is immediately produced by the jar of the sudden sag. And the evidence of this weakness is afterwards developed by the resistless force of expansion, which will surely find out the weak spots.

It is necessary now to show how this expansion comes about, and in what manner it acts upon the slab. And to show this a very homely illustration will best serve, viz., the phenomena attending the baking of what is called a "tin loaf" of bread. The dough with which the tin mould is filled expands with the heat of the oven. Being confined at bottom and sides by the mould, the dough expands upwards in spite of its own weight, because the force of expansion is greater than the dead weight of the dough. Being most free from contact and restraint at the center of its upper surface, it there rises highest, and so forms a dome-like roof to the loaf. The expansion in this way so distends the upper skin of dough as to exceed its ultimate tenacity—so the loaf cracks and opens at the crown to admit of the full degree of expansion due to the temperature to which the material is subjected. The tin moued so represses expansion that cracks in the sole of the loaf are very tiny or wholly absent.

If, before the loaf is half baked, but when it is set stiffly enough to sustain without visibly bending its own weight, if then it be turned out of its mould and supported (top side up as before) in the oven by a frame firmly gripping its four sides, but leaving its top and bottom free to expand, any further expansion which it undergoes will cause a de-

flection and cracking of the bottom skin rather than of the top skin; because in this case the force of the expansion and of the dead weight of the loaf act in the same resulting direction, viz., downwards.

The case is even so with the cement slab. The expansion which takes place, while the center sustains the dead weight, results upwards in spite of the dead weight. But in many cases, especially with thick floors, this expansion is known to continue perceptibly for many months; and when the centering is removed, at one week's or two week's or three week's limit after casting, though the concrete is much more than able to sustain its own weight, like the half-baked loaf, its expansion is incomplete; and the remains of that irresistible force, acting downwards, aided by the dead weight of the material and the leverage due to its span, distends the skin of ceiling beyond its ultimate tenacity, and causes cracks, which, though they are mere skin cracks, present a very unpleasant appearance, especially to the uninitiated, who naturally, though mistakenly, refuse to believe till convinced by actual experience that such cracks in the ceiling of a concrete floor detract little, if any, more from its enormous strength than the crack of a lath-and-plaster ceiling detracts from the strength of timber-joisted floor above it.

In order, then to avoid such expansion cracks, and the want of confidence in strength of floor which those cracks mistakenly but naturally engender, the wisdom of maintaining the center in position for at least five weeks (and as much longer as practicable) after casting concrete is sufficiently obvious.

In addition to the maintenance of centering a further and most useful, though very inexpensive, precaution against expansion cracks in concrete floors is the use of short iron cramps, embedded in the ceiling layer of concrete at the middle of span where the tension is sure to be most severe. These cramps, by resisting the stretch essential to deflection, compel the expansion, which cannot be repressed, to vent itself upwards, just as it would do if the centering, instead of the iron cramps, were bearing the stress of the dead weight.

Inasmuch as the compressive strength of cement concrete is about eight times its tensional strength, it will be seen that the sectional area employed in tension must be about eight times as much as that engaged in compression, in order for the tensional and compressional forces to be about equal to each other. Thus the great importance of the top layer, as the compressional member, so to speak, of the slab is evident. This consideration, together with the necessity for finishing the floor to stand the friction of traffic, shows the wisdom of putting a specially fine and strong finishing coat when as yet the main body of concrete is only a few hours set.

It is also important that while this finishing coat is green it should be jealously protected from the wear of traffic, as working men's rough shoes, etc., have often in this way damaged a floor skin before it set, and such damage is irreparable. The use of fine sand in the finishing coat should not be allowed. It disintegrates and spoils the surface texture.

The expansion of cement concrete during setting is effected by a practically irresistible force, to which the slab at once owes both its strength and its weakness.

If a long cylinder—say, for example, a metal hollow column—were well filled with cement concrete, the diameter of that concrete core would increase by expansion, in spite of the resistance of the column, but not to so great an extent as if unresisted. The resistance of the column to expansion does not, and cannot, reduce real, *i. e.*, molecular, expansion, but it compels the expansion to result in compression, which increases the density and strength of the mass. The metal column may or may not be cracked in the process; but either way, the density and strength of its cement core is increased in direct ratio to the bursting pressure which has been exerted on the column. Thus expansion contributes to strength of concrete in same ratio to the strength, or inflexibility, or inextensibility, or rigidity of the mould into which it is cast. If the column or cylinder were much thinner and more yielding at the middle than at the ends, the resistance to increase of core diameter by expansion would be less at the middle than at the ends, and, as a consequence, the core diameter would actually swell more at middle than at ends; and the strength of the middle, per unit of sectional area, would be less than at the ends, by reason of the less compression and density. Thus a very yielding part of any mould, by reducing the compression due to expansion, induces comparative weakness at that part.

Thus, in the case of concrete floors, when the centering has been removed, and the weight and leverage of the floor and its load are left to act in the same resulting direction with the thrust of such expansion as is still going on in the immature mass, the skin is consequently broken, and cracks appear just at those parts where the centering was most yielding. For example, if it be the case of a wide, long corridor floor, where no cross girders have been used, but where the concrete has been put down in one continuous slab, a crack will frequently appear, running from end to end of the corridor, right along the middle of the floor soffit, because the centers have not been well propped in the middle. In such cases the crack will run right to the end walls, if the floor or its centering, instead of resting on, has been simply butted against the end walls. But if the floor and centering have been properly supported on the end walls, the crack will terminate at each end of the corridor floor soffit, at about half the width of the corridor short of the end walls, *i. e.*, at miter-line intersections.

It is not always practicable, without great expense, to provide centering equally inflexible in every part. Indeed, it will generally happen that the centering of a slab will be weakest in the middle. By carefully considering the most flexible points of the centering, and the points of greatest bending moment to which the floor itself will ultimately be subject, the architect can place iron cramps, by anticipation, across the site of probable cracks, and imbedding these cramps in the substance of the floor, near the soffit skin, can so prevent the cracks occurring. In square slabs these cramps should generally be placed across the miter lines, and in rectangular slabs they should be placed mostly across the crown, and also across miter lines.

It is desirable to keep such irons as near the ceiling level as practicable; because if placed higher up in the concrete thickness they are nearer the axis of neutral stress, and are correspondingly less effective.

Evidently, when centering is equally inflexible at all points, repressed expansion, in the case of floor slabs, will be at all points in ratio to the weight of the floor; and the density will be, therefore, approximately equal throughout. And this, of course, is practically, or very nearly, the case in general practice.

But when the centering is removed before the expansion has ceased (as unfortunately generally happens), then the after expansion works differently from the former expansion, for, instead of inducing equal compression and density at all points, it induces greater compression and density of margins than of center of slabs; so (apart from tho question of centering-flexibility) accentuating and contributing to the weakness of the center of the slab.

Sometimes a yielding of centering occurs through the subsidence of some individual column foundation, or through the insufficiency or entire absence of some temporary prop or shore. Whatever may be the cause of the depression, the middle of the depression is the center of weakness, to which cracks radiate; as they do to the hole in a plate glass window through which or against which a stone has been thrown.

This brings us to remark that the likeness between the conditions of stress and behavior of window panes and of floor slabs is very close and instructive; and will repay investigation in some degree of detail.

It may be well at this stage to remark that well-holes and other holes through floor slabs should be of circular shape, or, at least, should have no square or sharp angles, because square and sharp angles are weak angles in cement concrete, as in cast iron. But when openings with square angles are formed (as they unavoidably must often be), then they can be strengthened by embedding short iron cramps of quadrant shape at the corners of openings. Also it must be remembered that if the hole be cut out of the corner of the square or rectangular slab, great loss of strength results; but not if the hole be cut out of middle of slab.

Expansion cracks often occur in concrete pavements laid upon *terra firma*, and the shapes and directions of these cracks always, more or less plainly, demonstrate the truth already expressed, that expansion cracks mark the lines of least resistance. If the edges of such pavement be confined between strong walls, or immovable abutments of any kind, the line of least resistance is midway between the abutments. Hence, in the case of a rectangle of, say, 10 ft. or 12 ft. wide, and of indefinitely extended length (as, for example, a passage pavement or street), if expansion appear anywhere it will be found generally expressed in one long medial line of crack. Again; if in a courtyard of, say, 12 ft. or 15 ft. square or diameter, the edge of the pavement be next immovable walls, and if the pavement be laid with very hot cement, the central point of the pavement will be the point of least resistance; and cracks will radiate therefrom having their fissures wider as they approach the point of convergence; and none of these fissures will extend quite up to the walls. If such a court were walled on three sides only, the point of common convergence of cracks would be found not in the middle of the slab, but nearer the uninclosed edge. If all the edges were uninclosed, and if the expansion were absolutely free to extend the mass horizontally in all directions, then no cracks would be seen so long as the measure of expansion did not exceed the measure of tenacity. But this is an impracticable freedom in the case of concrete pavements; the inertia and friction of the mass of the material where no other resistance offers, alone suffice to repress expansion's horizontal movement, and

compel it to issue vertically in the center. In such cases, however, the edges do move horizontally further from the center, and their expansion is horizontal, while the center does not move horizontally, and its expansion is vertical; and between these extremes of center and edges the intervening area of pavement expands both vertically and horizontally, the vertical element predominating towards the center, and the horizontal element predominating towards the edges. For, as will be seen, the inertional and frictional resistance to horizontal movement of mass is at zero at the edges; and the inertional and frictional resistance to vertical movement of mass is at zero at the center. Practically the horizontal expansion, though real, is infinitesimal, resulting in compression rather than in visible displacement of mass, while the vertical expansion is more pronounced. And thus it comes about that pavement laid with hot cement in large slabs on solid ground will crack by expansion even when the edges are comparatively unconfined. And in fact free expansion does exceed the tenacity of skin when the skin area is small in comparison with the volume of mass; and so it is only by repressing expansion we prevent skin cracks, and at the same time, by means of the force of compressed expansion, compass and consolidate the concrete. Thus it is a fact, however paradoxical, that expansion compresses and strengthens the material by virtue of the resistance it encounters. The resistance is greatest round the edges, and least at the center, and the concrete is consequently stronger, and more consolidated, to a slight extent, round the edges than at the center of slab—a fortunate fact, for the edges of slabs of self-sustained floors need more strength than their centers.

Here, again, the loaf of bread admirably illustrates the same truth, for whether it be a "tin loaf" or a loaf baked without any mould, the edges of the sole are invariably the hardest and strongest crust, because at these edges the forces of expansion have met their toughest fight with resistance. Of course, irregularity of structure, due to the imperfectness of dough, may cause an occasional expansion crack even round the edges of the loaf sole. But such cracks are extremely exceptional. Similarly a section of extra hot cement will blow and cause a crack anywhere. But such irregularities are to be obviated by well mixing before setting the material; and it is of the utmost importance to thoroughly mix the dry cement and aggregate before applying moisture.

The expansion of concrete floors must not be understood to imply or involve simply an increase of bulk; for while the interior of the slab's volume is still expanding, the exposed exterior surface has not only reached the limit of its expansion, but has actually, in most cases, begun to contract. And this contraction of the upper or exposed surface co-operates with the swelling of the heart of the slab to produce not only cracks across the slab, but also a shrinkage around the skirting or edges of the slab, which in some cases is very noticeable, though of no practical consequence, generally speaking.

(To be continued.)

Papers Read at the Dunfermline Meeting of the North British Association of Gas Managers.

The 28th annual meeting of this Association was held on the last Thursday of July, under the Presidency of Mr. George R. Hislop, of Paisley. The President's inaugural dealt mainly with practical questions, and his references to the water gas agitation which England is now sharing are given in another column. Turning to the paper list, which was well filled out we herewith print a *resume* of some of the communications, our account being taken from the London *Journal:*

Notes on Main Laying.

The first paper was entitled "Notes on Main Laying;" the author being Mr. John M'Crae, of Dundee. After making a few remarks regarding the very indifferent quality of the cast iron of which pipes had been made in recent years (some of them being so brittle that they would sustain comparatively little external pressure), he proceeded to say that the destruction of gas mains has of late been much increased by steam traction engines, the use of which was one of the points of his notes. Supposing they laid a long distance of gas main, and the street was not left so smooth as they found it, the zealous burgh surveyor, anxious to restore the thoroughfare to its original beauty, applied his heavy steam roller to the track, with the result that in many cases, owing to the rapid and severe crushing down or consolidation of the roadway, the main was subjected to a pressure which it was unfit to withstand, and fracture was the result. The service pipes, too, which were generally connected at right angles to the main, were either disconnected or broken. He supposed it had been ruled that these steam rollers and traction engines, etc., were to be classed as ordinary traffic; and gas suppliers must, therefore, see to their property not being injured by them. With this view, he suggested that all cast iron pipes should be composed of iron of a known brand, which should be able to withstand a given pressure; and that samples of the iron should be taken while the pipes were being cast. He referred to the test bars specified by Mr. J. Watson, the Dundee Water Engineer; and then remarked that he would have the pipe laid at such a depth as to be, as far as possible, beyond the reach of the strain caused by extraordinary traffic. Under general circumstances, a depth to ensure a cover of 2 ft. 6 in. should be sufficient. A large trunk main, not likely to be disturbed for services or connections, he would lay much deeper. An advantage of increased depth was the removal of the pipes from atmospheric variations, and consequently the prevention of excessive condensation of the richer hydrocarbons. For some years he had adopted the practice of laying the mains almost under the side channels of the streets; thereby escaping the heavy traffic, and causing little interruption in lifting and relaying. In an important street, he would lay the main on either side, and so avoid what was always a source of great loss of gas and annoyance—namely, crossing pipes. If the street had only a few consumers on the side opposite that on which the main was laid, he would have one crossing main, with a small main running in front of the buildings to be supplied; and he would avoid as far as possible crossing mains or services.

Mr. M'Crae subsequently remarked, in reference to the laying of mains, both large and small, that it was not only desirable that the joints should be carefully made and be perfectly gas-tight to commence with, but that they should be laid on a solid bed; otherwise the permanency of the work could not be ensured. Then there was the question of coating the mains, both to hinder corrosion and to reduce the friction, and he gave the results of his experience on the matter. He recommended that the mains should all be of ample capacity; and this recommendation came, he said, with special force in these days, when gas engines are becoming so generally adopted—frequently causing annoyance from the oscillation of the gas lights in their neighborhood. A large main served as a reservoir from which a gas engine could be supplied without inconvenience to any one. The author then made some excellent suggestions in regard to service pipes—how they were to be laid, and how connected with the mains. He was much opposed to having screw connections between the mains and the services, and gave his reasons for his practice. He also made some remarks as to the weights of service pipes, which he thought were generally far too light; and he mentioned the weights of the pipes which he himself used for services up to 3 inches in diameter, as the result of long experience in his own practice. In reference to malleable iron service pipes, he said he would on no account lay them without having them properly coated to prevent oxidation; and all such pipes received from him two coats of the best red lead. Then, as to the material in which the service pipes were laid, great care should be observed, especially if the soil contained anything like ashes. In concluding his remarks, Mr. M'Crae mentioned his practice in regard to large service pipes for supplying mills, factories, and other extensive works; stating that he did not put meters in every part of the works, and carry service pipes to each of them—his rule being not to place the meters and pipes beyond the control of the gas people, but to place a large meter in or near the lodge at the gate, to which the service pipes were connected, leaving the consumer to carry the pipes wherever he wished.

A long discussion took place upon the questions raised by Mr. M'Crae; and generally the speakers complimented him upon the practical and useful character of his paper. The first speaker was Mr. Whimster, of Perth, who regarded the depth of 30 inches for the mains as a very suitable one—never in his own case coming nearer the surface. In some places he even went down to a depth of from 7 to 7½ feet. As to laying malleable iron service pipes, he mentioned his plan as to jointing them with the mains, and stated that he not only coated them with red lead, but he also placed them in a box for protection—a practice which, he said, ultimately repaid itself well. Mr. Bell (late of Clippens, now of Edinburgh) made some remarks on the coating of pipes inside; and Mr. Smith, of Aberdeen, also spoke on the same subject—stating that in his case the ordinary coating inside such pipes had come off. Mr. Mackenzie of Dunfermline, said one of his 2-inch pipes had become quite blocked up with the tar coating that had been dissolved off the inside. Mr. Macpherson, of Kirkcaldy, agreed with the author of the paper in regarding the quality of the iron used in making the pipes as an important factor in their durability. The nature of the soil was another; and any bad soil that was met with in a pipe track should be removed and good material substituted. He had found the internal coating of pipes very speedily removed. As to unaccounted-for gas, he said that it was not wholly due to leakage from bad pipe laying, but also to the temperature

of the gas being lowered too much—a subject on which he enlarged to some extent. Mr. D. M. Nelson, of Glasgow, recommended that the coating of the pipes with a protecting mixture should be done after the laying of them, and on the outside only; and Mr. M'Gilchrist, of Dumbarton, had only one suggestion to make, which was that the tar used on the inside of the mains should be added to the outside of the service pipes. Mr. Key gave his experience in laying mains and service pipes in Dumbarton. Mr. T. D. Hall, of Montrose, said his own practice with service pipes was, as far as possible, to connect them with the tops of the mains; and as to the coating of the pipes with tar mixture, he agreed with Mr. Nelson. The President, in summing up the discussion, remarked that he was in favor of coating pipes outside; and urged that pipes should be cast on end. His own practice was to lay pipes under the footpaths on both sides of the street; and where a large main had to be employed he placed it in the roadway, but very deep. Mr. M'Crae replied very briefly; observing that the criticism was better than the paper. As to Mr. Bell's remark about the removal of the tar coating from the inside of the mains by the action of the gas and liquid hydrocarbons, he said that he had not had the same experience as this gentleman, nor had he found that the paint used inside a gasholder had been taken off by the action of the gas, even after the holder had been 31 years in use.

Mr. MacPherson on a Retort Setting for Small Gas Works.

Mr. A. MacPherson, of Kirkcaldy, read a short paper on this subject, which he illustrated by means of a diagram. The retort setting he described had been devised by himself, and was now in actual use at the Dysart gas works. After making a few remarks regarding the anxiety shown in recent years by the managers of small works to obtain some of the benefits which accrue by the use of regenerative settings he went on to show how he had attempted to design a setting to effect that purpose. It very much resembled the ordinary setting of three retorts in one oven; but he had introduced a "new departure" in drawing the primary air along the top of the main flue in a space specially formed for the purpose, after which it was passed under the setting, and immediately beneath the fire-bars of the furnace. These bars were placed at a considerable angle, so as to obtain as great a depth of fuel as possible. He then introduced what he said might be termed a secondary air supply by forming flues under those used for heating the lower retorts, that supply of air traveling to and fro, and being ultimately led up through three spaces formed in the cheeks of the furnace, and discharged into the latter immediately over the fuel, so as to be brought into actual contact with the gases emanating from the same. By this arrangement he had secured a considerable rise in temperature, as compared with that obtained in the old settings, and at a much reduced cost for fuel, which amounted to about one-third of the quantity formerly required. The spent coal was drawn red-hot from the top retort into a hopper placed in an opening between the mouths of the two lower retorts; thus saving all need for shovel firing.

An Ideal Gas Company Realized in New Zealand.

At last year's meeting of the Association, held in Glasgow, a paper on the subject of "Selling Gas" was read by Mr. J. M'Gilchrist, in the course of which he advanced certain points, or principles which, when taken as a whole, formed in his opinion the basis of an ideal gas company. He admitted that there was some ground for the opinion expressed during the discussion on the paper that his ideal company was rather chimerical in character and composition; but still he thought those persons who had expressed this opinion must now have come to his way of thinking, if they had in the interval given fuller consideration to the subject. This ideal company had been regarded somewhat like the ideal man; but he was prepared to prove that it really existed, and that it was, of course, the product of the human mind. Such a company as he had pictured to himself and to the members, strange to say, really existed, although he did not know of it at the time of reading his paper last year; and, stranger still, the company existed at the Antipodes, where gas making as an industry was yet in its infancy. The science of selling gas, however, at the place referred to was greatly in advance of the practice in this country. After giving an interesting introductory statement, Mr. M'Gilchrist mentioned that his ideal gas company had been realized in the town of Napier, New Zealand; the manager of the gas works being Mr. Charles H. Edwards. This gentleman had seen the paper and the report of the discussion thereon; and he at once communicated with the author of the paper, informing him that his ideas had been already put into practical operation by the company of which he was the secretary and manager. The letter sent by Mr. Edwards was of a highly interesting character; and Mr. M'Gilchrist embodied it in its entirety as part of his paper of the present year. In the course of his communication, the New Zealand manager dealt in detail with all the points which M'Gilchrist had raised, and stated unreservedly that they were each and all in practical operation in connection with the Napier Gas Company, Limited. We may mention, in passing, that Napier has a population of 7,000; that the consumption of gas, which was 4,500,000 cubic feet in 1878, was expected to amount to 17,000,000 cubic feet in the past year—the population during the decade having only increased to the extent of about 1,500. As to hiring out of apparatus, which was one of Mr. M'Gilchrists points, the letter from Napier stated that upwards of 200 cooking stoves were in use, and about 120 heating stoves; while boiling burners, bath heaters, and iron heaters were in use by almost every consumer. All the gas burned in this way was subject to a larger discount than the gas used for lighting; and separate meters were put on for it. As regards the payment, Mr. Edwards stated that their system of collecting gas rents was monthly, and not bi-weekly or weekly as had been recommended by Mr. M'Gilchrist. The net price of the gas used for lighting was 10s. per 1,000 cubic feet; and that for stoves and engines, 6s.—being the cheapest in the colony. With an annual income of £7,753, the amount lost by bad debts was only £3 9s. 4d.—a percentage which could only be described by a decimal. The day consumption for stoves and engines, when the letter was written, was about 31 per cent. of the total amount, and was on the increase. As might naturally be supposed, this communication from Mr. Edwards excited a considerable amount of interest among the members.

Forty Years' Experience with Purifiers.

Mr. J. Hall, of St. Andrews, who is now seventy years of age, therefore well entitled to be regarded as an "old hand," detailed experience with purifiers over a period of about forty years. Beginning in 1851, when the yearly make of gas was 3,706,000 feet (price 8s. 4d.), the superficial area of each of three purifiers was only 18 square feet; making 54 square feet in all. They were so arranged that, before any one of them could be changed, the make of gas had to be stopped; the result being a great waste of lime, of which 39 tons were used in one year. He went on to mention the changes made in the purifying plant, and the extensions of the same in subsequent years. In 1888 the make of gas was 22,000,000 cubic feet, and the lime used only 48 tons, upwards of 2,000 cubic feet of gas being purified for 1d., and the price of gas being reduced to 3s. 7d. In this year also the purifiers were still further increased in size. Mr. Hall stated that the few general notes submitted to the members were intended to show the advantage of large purifiers in the saving of materials—lime and oxide—and labor, in reducing the pressure and speed, and in the security given for the purity of the gas. The new purifiers he had in use had each a superficial area of 160 square feet, and was capable of easily dealing with 200,000 cubic feet of gas in 24 hours.

Sunday Labor in Gas Works.

This subject, which has often been discussed at meetings of gas managers, was dealt with in a paper submitted by Mr. T. D. Hall, whose father had just engaged the attention of the meeting on a totally different subject. Like his father's paper, it did not profess to give anything specially novel on the subject; but it stated that at the Montrose gas works it was the rule rather than the exception not to make gas on Sundays—at all events, between the hours of 6 A.M. and 6 P.M. The make of gas at Montrose is about 26,000,000 cubic feet per annum; and the maximum daily production about 150,000 cubic feet, for which there is ample holder capacity. While the rule during the week is for the stokers to be 12 hours on duty, Saturday is divided into three shifts of 8 hours—each gang of workmen taking 8 hours alternately. The last charging of the retorts is done at 5 o'clock on the Sunday morning; so that by 8:30 A.M. the charges are all worked off and the lids are slackened as each charge runs out. When the flame disappears at the mouthpieces, the lids are screwed up again, to keep the air out of the retort and prevent the coke from burning. Mr. Hall mentioned other details of his work attendant upon this mode of dealing with the carbonizing operations; and said that by keeping his manufacturing power a little above his actual requirements he was not only able to give his stokers a rest on Sundays, but was relieved of some worry himself. This was his share of the benefit derived from cessation of work on Sundays.

The good people of St. Louis are waking up to the possibilities (for the projectors) involved in the scheme for a municipal gas supply, under the provisions of the bill recently passed by the St. Louis House of Delegates. A recent number of the St. Louis *Republic* characterized the scheme as "startling in its boldness." And startling and rascally the scheme undoubtedly is.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Maryland Meter and Manufacturing Company has opened a branch office at No. 330 Pine street, San Francisco, Cal.

SOME months ago Mr. Philip Morley, Superintendent of the water supply system of East Liverpool, Ohio, completed a rather remarkable feat in practical engineering. A plan of street regrading determined upon by the authorities had the effect of depressing the grade below the level of the mains for about 1,000 feet, wherefore it became necessary to lower that whole length of a line of 10-inch pipe from 6 feet to 9 feet. The operation was quickly and successfully accomplished, without interrupting the service, in the following manner: A trench was opened exposing the whole length of the piping, and cross-trenches were opened along all the branches. Cross pieces were then placed at each hub and wedged up to a bearing, and between them the trench was excavated to the required depth. Then, from the bottom, piers were built up of wooden blocks at each joint, and the pipe transferred to a support on them. Suitable wooden trestles were placed across the trench at intervals of 15 feet, and provided with levers. Slings were passed over the short ends of the levers, at the opposite end of which a laborer was stationed. At a given signal all the levers were depressed and the pipe swung clear of the piers, which were cut down and the pipe lowered back on to them. The lateral branches were similarly lowered, and then another section was lowered, and so on, the work being carried out in 100-ft. sections. When the bottom of the trench was reached the joints were all recaulked, though no leaks and but moderate sweating had been anywhere observed. The trenches were afterward filled in by a two-horse scraper.

THE bids submitted in response to the invitation of the authorities to contractors to figure on the public lighting of Kankakee, Ills., were as follows: Kankakee Electric Company, 40 arcs (2,000 candle power each), for a total of $2,850 per year, or $71.25 per light per annum, payable monthly. The table of lighting was based on the Philadelphia schedule, the city to have the privilege of ordering the lamps to be lighted at any other hours not provided for in the schedule by paying 4 cents per light per hour. Any number of lamps in excess of the 40 could be obtained at the same proportionate rate. In addition, the Company agreed to furnish sufficient incandescent lights to illuminate the City Hall and Engine House, and to place one 32-candle power lamp in front of the former building. The wiring and lamps are to be put in without expense to the city. The Company further agreed to arrange the system of supply so that the entire city circuit could be availed of in case of fire as an all-night circuit. The Westinghouse Company agreed to put in a complete plant—city to furnish building and set boiler—for 40 arcs (2,000 candle power each) for $9,321. One section of the Ball Electric Company agreed to put in a plant rated to the capacity of 50 arcs (1,000 candle power each) for the sum of $7,085, the city to furnish the building. The Cumberland Construction Company (Plattsburg, N. Y.), proposed to put in a plant of 50 arcs (1,200 candle power each), for $7,953. The National Electric Company (Eau Claire, Wis.) offered to put in a plant of 45 arcs (2,000 candle power each), two 30-light dynamos, and a 60-horse power engine for $10,000, the city to furnish building. After some haggling and a not very harmonious discussion, it was decided to award the contract to the first-named bidder; and we are of the opinion that the task is sure to result in either one or two ways: First, if the contractors faithfully adhere to the terms of the bargain, they cannot fail to lose at least 12½ per cent. per annum on the contract price; second, that if this loss is not sustained, the public lighting of Kankakee will be nothing more than a farce.

MR. WILLARD SMYERS, Secretary of the Board of Gas Works Trustees, Hamilton, Ohio, writing under date of Aug. 8, says that four bids were received in response to the advertisement for gas pipe and specials. The Addyston Pipe Company, which secured the contract, made the following tender:

4-inch pipe, at $28.75 per ton of 2,000 lbs.						
6	"	"	26.75	"	"	"
8	"	"	26.75	"	"	"
12	"	"	25.75	"	"	"

with special castings to be furnished at the rate of 2.4 cents per pound.

SOME time ago we intimated that the authorities of Galena, Ills.—and the people too—were greatly dissatisfied with the quality of the public lighting supplied under contract by the Galena Electric Light Company—16-candle power incandescent lamps were employed. The electricians contended that the lighting was fully up to the standard promised, but the Council declined to audit the bills that were presented for the service. Something less than a fortnight ago the Company made another determined effort to secure a "payment on account" and this attempt seems to have precipitated a settlement of the affair, but of a nature not bargained for by the electricians. The bill having been read and a motion for its payment made, Ald. Jackson objected to such a course and moved an amendment "that in the original contract between the city of Galena and the Galena Electric Light Company, the latter had guaranteed to furnish a better light than the one then in use by the city—*i. e.*, the light furnished by the Galena Gas Light Company—and as the light furnished by the Electric Light Company was not as good as that which had been supplied by the Gas Light Company, with the consequence that the terms of the contract had not been fulfilled, therefore the city was released from responsibility under the contract, and that the Electric Light Company be at once notified to desist from lighting the streets." The amendment was adopted, and the Gas Company will be authorized to take up the lighting. It seems to become plainer every day that incandescent electric lamps have no standing as efficient illuminators of roadways.

ACCORDING to returns recently filed the proprietors of the Gloucester (Mass.) Gas Company have small reason for complaint at the financial standing enjoyed by their enterprise. The figures submitted show the following: Capital paid in, $62,300; assets, land, buildings and wharf, $44,835; machinery, including pipes and meters, $22,465; cash and bills receivable, $9,294; manufactures and merchandize, $3,469; loans, $13,300. This shows a credit to profit and loss of $31,063.

ACCORDING to the last weekly report of Mr. P. B. Wilson, Inspector of gas and illuminating oils for Baltimore, the average illuminating power of the gas supplied by the Consolidated Company was 25.10 candles, or 5.10 candles in excess of the legal requirements. Of 120 samples of illuminating oils tested, three flashed at the standard temperature—120° F., the balance varying from 120° to 129° F. The density of the oils ranged from 46° to 49° B.

"RUMORS have not been lacking to the effect that the fuel gas plant recently installed by the American Watch Company, at Walthan, Mass., was not working as well as its promoters anticipated. These statements may be replied to in two ways—the gas does good work in its various applications to melting, annealing and the firing of enamel; but I imagine that the cost of its production is rather greater than that shown in the estimate originally prepared. The producer gas has been used to fire a single boiler, and it is said to have given satisfaction, although I believe the period of experimenting with a view to determining the best burner to use in its combustion is not yet ended. Master Mechanic Marsh, on being appealed to in respect to the economy of the fuel water gas as compared with coal, said: 'We have not yet gotten around to a careful series of tests to determine the relative economy of the system as compared with the use of coal, but all considerations of comfort, convenience and cleanliness apart, the system certainly *promises* well as an economical one. We shall doubtless use as much coal in our generators as under our boilers, but from this amount of fuel shall be able to run our boilers and also supply the furnaces throughout the works, for which before we had to use extra coal or buy the regular coal gas. In the case of other manufactories the producer gas might seemingly be employed for fuel under the boilers as we employ it, and the water gas be used for illuminating purposes. We shall *probably* put the producer gas under others of the boilers though not under all at present.' As near as I can estimate it the Watch Company consumes about 50,000 cubic feet of water gas per day in its various departments, and electricity is still used for lighting the establishment. It is only fair to say that Mr. Marsh, who is a careful and painstaking man, believes firmly in the efficacy of the Watch Company's fuel gas plant.—OBSERVER."

SOME time ago we reported the introduction of an ordinance in the City Councils of Philadelphia authorizing the Department of Public Works to supply gas to consumers resident outside of the county of Philadelphia. In the discussion that followed it was urged that the proposed ordinance was illegal, in that it sought to confer improper powers upon the municipality. The matter was referred to City Solicitor Warwick, who has rendered an opinion to the effect that the ordinance is a valid one. Having cited many precedents, the Solicitor says: "The ordinance submitted to me authorizes the Department of Public Works to supply the gas to consumers resident in adjoining counties 'whenever it shall be to the interests of the city so to do.' There is nothing compulsory in this, and no duty to supply is imposed. When the Director of

the Department of Public Works believes it will be to the interests of the city to make a contract, he will have the power so to do. When he believes it will not be to the interests of the city he will have the right to refuse to contract. The ordinance further provides that the Department of Public Works shall make such regulations for the supply and collection of moneys due for consumption of gas as may be deemed proper. The right to make all reasonable regulations has been frequently sustained by the courts. It is further provided that any pipe necessary for supplying such gas shall be paid for by the consumers. The ordinance does not pretend to give any right to use highways or private property without consent, nor does it seem to contemplate the purchase of land, or the construction of works outside of the city, but simply the supply of gas through pipes paid for by consumers, and laid with the consent of the legal owners of the ground. If the city in its strictly municipal capacity were about to engage in this enterprise, I should doubt its power. The Supreme Court, however, having repeatedly decided that the city has a legal right to contract like any duly chartered business corporation, I do not know of any principle of law which estops such a corporation from making such contracts for the sale of gas in adjoining counties as have been pronounced valid in this county. In this opinion I have taken into consideration only the ordinance submitted and the inherent right of the city to contract for the sale in other counties, and *have not considered* the restrictions which may or may not exist upon this right by reason of charters granted to gas light companies in adjoining counties." This opinion seems to conflict.

DURING the six months ended June 30, last, no less than 45 orders for the Cabot gas tray specialties were received and filled. The factory at Eleventh avenue in this city is now so well equipped that orders can be filled without delay.

WE understand that the insurance companies have paid the risks held by the Citizens Gas Light Company, of Brooklyn, N. Y., on the holders destroyed by explosion on the night of Jan. 8, 1889. We believe the amount involved was $62,500.

WE are indebted to a correspondent for the following particulars respecting the electric installation of the Woonsocket (R. I.) Gas Company, the progress of which it may be taken for granted is being carefully watched by Superintendent Jenks: "The Woonsocket Gas Company is actively at work and has made considerable progress in the matter of arranging for an electric lighting service throughout the city. The building is completed, most of the machinery is on the ground, and the line work is well under way. The building for housing the apparatus is on the land of the Company, close by the coal gas plant, and joined to the structure which contains the water gas plant. It is one story in height, 45 by 60 feet, and is built of brick. The walls are 12 inches in thickness, and 18 feet high; the distance from the floor to the apex of the roof—of the trussed pattern—is 21 feet. All the rooms, which are well lighted, are sheathed in hard pine. The single floor is divided into four rooms—the main one, to contain the motor power and the dynamos, is 45 by 50 feet, to the rear of which are the workshop (9 by 18 feet), storeroom (9 feet by 13 feet 6 inches) and the toilet room. Under the floor of the main room are substantial foundations for other engines, dynamos and shaftings, with ample floor space for an extension of the service. The motive power is to be derived from a 50-horse Otto gas engine, supplied by Schleicher, Schumm & Co., of Philadelphia. The weight of the engine is 10 tons, and the balance wheel weighs 3,800 lbs. The crank shaft, which is of Bessemer steel, was constructed at the Krupp works, at Essen, Germany; it is 5½ inches in diameter, and 5 feet 4 inches in length. The balance wheel and driving pulley are each 72 inches in diameter, and the cylinder is 14½ inches in diameter. About 1,000 cubic feet of gas per hour will be consumed in operating the engine. The latter will be belted to a counter-shaft 13 feet in length, carrying a balance wheel and three clutch pulleys, from which belts will be run to the dynamos. The Brush system is to be employed. Only two arc machines are at first to be put in service, both being now set up and connected. The capacity of each machine is 45 lights of 1,200-candle power each. The initial two arc light circuits in the city will necessitate the stringing of three miles of No. 6 Grinshaw black insulated wire. The poles, apart from those on Main street, will be of chestnut, 35 to 50 feet in height. The Main street poles are to be of hard pine, 8 inches square at the butts, and 6 inches at tops, and will range from 35 to 45 feet in height. Mr. C. P. White, of the Brush Company's home works at Cleveland, O., is superintending the installation, and Superintendent Jenks is confident that the system will be in working operation by October 1st."

THE United Gas Improvement Company's plan of mainlaying extension at Paterson, N. J., contemplates the supply of gas in South Paterson.

AN important plan of betterments on the El Paso (Texas) gas works is under consideration. The El Paso Gas Company exports gas to Mexico, and Major Gordon does not seem to care greatly whether the product is protected or not. El Paso seemingly has a bright future before it.

THE Commissioners of Highways, of Flatbush, L. I., have granted permission to the Flatbush Light and Fuel Company "to lay conductors and mains through the streets of the town for the purpose of furnishing gas." This is the Company the incorporation of which by Messrs. Chas. G. Francklyn and associates was reported in our last. The Flatbush supply will be made from the works in Brooklyn said to be under control of the Francklyn syndicate.

AT the special election held in Lansingburgh, N.Y., to decide whether electricity should be used for lighting the streets, 343 votes were cast, 225 being in favor and 118 against. Another query in the balloting was as to which Company should receive the contract in accordance with the proposals submitted some weeks ago, the same having been reported in the JOURNAL. This question was settled in favor of the incandescent system proposed in the bid of the Union Electric Light and Power Company. The "intelligent voter," when left entirely to his own resources, can always be counted upon to make a wrong selection; for in our opinion the proposal they ratified in the Lansingburgh ballot was the most inadequate one submitted.

THE Hay Electric Light Company, of Hamilton, Canada, has made an assignment. The liabilities are under $5,000, and M. D. Bair, of the Montreal Edison Electric Light Company, is returned as the chief creditor.

THE powers that are in Buffalo, N. Y., recently ordered that a certain portion of Bird avenue be lighted by electricity. Several of the residents in the district designated, however, are seemingly not anxious for the change, since they have applied to the courts for an injunction in restraint of the authorities. In their application they state that the gas lamps now in use are all sufficient for the illumination of the roadway, and that gas is much cheaper than the electric light.

WE understand that Mr. Edward Weber, of this city, has secured the contract for excavating the tanks and constructing the tank walls for the reception of the gasholders to be erected by the Metropolitan Gas Company, at Elizabeth, N. J.

THE Washington (D. C.) *Capital* says that the Washington Gas Company will ask the courts to enjoin the Electric Heat and Power Company, of Pittsburgh, Pa., from carrying out its scheme of opening the streets for the purpose of burying electric lighting conductors therein. The gas men claim that Congress has vested them with the exclusive right to open the streets for the purpose of placing such conductors. The local United States Electric Lighting Company will side with the Gas Company.

THE Comptroller of Allegheny City, Pa., last Friday opened bids for the construction of a municipal electric lighting plant for that place. We are not advised as to the figures submitted, but understand that the propositions, as a rule, were not particularly pleasing to the authorities.

THE Albion (N. Y.) Electric Light Company has been formed. Its officers are: W. G. Swan, President; G. W. Barrell, Secretary; E. K. Hart, Treasurer. The Westinghouse Company is to furnish the plant.

EARLY last June a certain party registered at the Grand Hotel, Cincinnati, as George N. Torrence, of Philadelphia. He subsequently called on Gen. Hickenlooper and informed the latter that, as a representative of the Brooks' Gas Process Syndicate, he was anxious to purchase the plant and franchises of the Cincinnati Gas Light and Coke Company. The General said that while the works could be bought, they would "come pretty high." Torrence finally made an offer of $20,000,000 for the property, and "took his departure" for a few days to raise the money. He forgot to come back, and the Grand's clerk is wondering when Torrence's board bill will be paid.

THE National Gas and Electric Construction Company has been organized at Nashua, N. H. Its officers are: President, L. M. Child; Vice-President, G. H. Drew; Secretary, F. M. Smith; Treasurer, C. E. Powers; Clerk, Fred. Whittemore.

MR. A. FOSTER MCKISSICK has been appointed Superintendent of the Columbia (S. C.) Gas and Electric Light Company.

THE charter of the Missouri Gas Company, of St. Louis, having reached its original limitation, a reorganization and reincorporation of the same was effected last week. It is capitalized in $200,000. Those most largely interested in it are Messrs. Wm. Somerville, S. A. Grove, John P. Helfenstein, F. B. Ewing, F. H. Young and E. M. Bowman.

THE Northampton (Mass.) Gas Company is extending its main system, and proposes to make other betterments next year.

AT the last regular monthly meeting of the Directors of the Mutual Gas Light Company, Southbridge, Mass., it was determined to grant a discount of 5 per cent. to all consumers who used between 1,000 and 2,000 cubic feet per month, the discount to rule at 10 per cent. where the monthly consumption exceeded the maximum quantity named. The gross rate is $3 per 1,000.

AT the annual meeting of the New Bedford (Mass.) Gas Light Company the only change in the Board of Directors was the naming of Horatio Hathaway to fill the vacancy occasioned by the death of Lemuel M. Kollock.

IN a paper on the "Electrical Distribution of Heat, Light and Power," by Mr. Harold P. Brown, the author reports that since the introduction of arc lighting 91 deaths have been traced to the electric currents thus employed.

THE San Jose (Cal.) Light and Power Company, with a capital of $1,000,000, has been incorporated by Messrs. Chas. Otter, H H. Kooser, E.W. Clayton, C. A. Hagan, H. J. Edwards, C. T. Ryland and Amasa Eaton. The propose to operate gas works, electric light and power plants, and electric street railways.

THE incandescent lighting plant recently installed by the Pacific Electrical Storage Company at the Reno (Nev.) State Insane Asylum has a capacity of 140 lamps of 16-candle power each. The authorities are not very well satisfied with the illumination so far obtained from the system. Water power is to be used "when the Truckee river is high enough," but when the Truckee refuses to rise steam is to be relied upon.

JUDGE WALLACE (sitting in U. S. District Court Chambers) has handed down a decision which will no doubt have an important bearing in some pending suits over the validity of certain electric light patents. The case decided was that of Pope *et als.* against the Anchor Brewing Company, the question at issue being a patent for barrel scrubbing machines. Pope obtained letters patent in this country in 1879 for an improvement on a patent that had been granted in 1877 in Germany. Defendants contended that their use of the machine was in no sense an infringement, because the original German patent had lapsed, thus terminating the life of the patent here. The Westinghouse Electric Company assisted the Brewery Company in this line of defense, the Edison Company siding with the plaintiff. In substance, Judge Wallace's decision is to the effect that the statute is capable of the meaning that the exclusive right to a patent here is to cease with the lapse of a similar right possessed by the patentee in any foreign country.

THE Havana (Ills.) Electric Light, Heat and Power Company has been incorporated by Messrs. V. P. Turner, O. B. Thorp and N. C. King. Capitalized in $15,000.

MR. LITTLEHALES, of Hamilton, Canada, dropped in on us last Wednesday, and wishes us to assure the members that it will be a very serious matter that will prevent him from responding to his name at the Baltimore gathering next October.

THE Boston *Post* says that considerable curiosity exists as to the price the Bay State Gas Company's stock will sell for when first traded in at the exchange. It is understood that transfers have been made at $60.

THE Lee (Mass.) gas works are being renewed. Mr. Dresser thinks that the plant will be in operation on or before the 1st prox.

THE proprietors of the Amherst (Mass.) Gas Company will install an electric plant of the Westinghouse type. Gas engines are to furnish the power.

A FEW days ago, during the operation of altering some of the connecting pipes in the gas works attached to the woolen mills of the R. Forbes Company (Hespeler, Ontario), an explosion occurred that about wrecked the gas plant. The roof of the generating house was blown off, and the walls of the buildings were badly strained. The gasholder was also punctured in several places. Damage, about $3,500.

THE Thomson-Houston Electric Company is said to have purchased the entire stock and assets of the Van Depoele Electric Manufacturing Company, of Chicago. The latter, after the sale some time ago of its railway patents to the Thomson-Houston Company, retained its arc lighting business, and also was in receipt of a certain royalty per car on all cars manufactured by the Thomson-Houston folks. The arc lighting interests thus purchased will probably be turned over to the Fort Wayne Electric Company, which is virtually a branch of the Thomson-Houston Company.

A DESPATCH from Columbus, Ohio, says that what promises to be a bitter fight between the Hamilton Gas Light and Coke Company and the city of Hamilton, Ohio, has been started in the State Supreme Court. The case is entitled "The State of Ohio, on the relation of D. K. Watson, Attorney General, against the city of Hamilton, Butler County." The questions involved are of considerable importance to every city of the State, since they are far-reaching and virtually raise the point whether or not a municipality has the right to establish or permit to be established a competing gas plant, where a previously organized Company has secured the franchise for the use of the streets. The last General Assembly authorized the city of Hamilton to issue bonds to the amount of $150,000 for the purpose of purchasing or establishing a gas plant. The city authorities are now proceeding with the work, being engaged in laying pipe through the streets and alleys, and the Company comes into court to stop them. Complainant sets up a long array of reasons for this action, stating that it was incorporated in 1855 for the purpose of supplying gas to light the streets and to supply the same to the citizens of the city; that it has laid 30 miles of pipe and has complied in all respects with all laws and ordinances, and is therefore entitled to all the rights, privileges and immunities secured under the laws of the State. The Company complains that now the city is erecting gas works, laying pipes in the same streets occupied by the Company's lines, for the purpose of competing with the Hamilton Gas Light and Coke Company in supplying gas for public and private consumption; that the city is illegally issuing bonds and incurring an indebtedness to the amount of $150,000, and levying a tax to pay the same, and, further, that $50,000 of these bonds, after being refused by the bidders, were afterwards sold to private parties at the lowest bid, without being re-advertised or an opportunity offered for competition in the purchase. "All of these privileges and liberties," says the petition, "the city usurps upon the State to its great disadvantage and prejudice, and the court is asked to compel the authorities to file an answer showing by what right or authority of law an attempt is being made to establish a competing gas plant."

ARTICLES incorporating the Cedar Rapids (Iowa) Fuel Gas Company have been filed. The capital stock is $50,000, and the officers are: President, L. S. Merchant: Vice President, C. G. Greene; Secretary, H. W. McIvor; Treasurer, J. B. Henderson.

THE Waterloo (Canada) Gas Company has been incorporated. This place is a village in Waterloo county, Ontario, and is on a branch of the Grand river at a point two miles west of Berlin. Population about 5,000.

THE works of the Chippewa Falls (Wis.) Gas Light Company were badly damaged by fire on the night of the 9th inst. The loss is put at $3,000, with no insurance.

MR. NUSSBAUM, who was awarded the contract for the public lighting of Macon, Ga., by electricity, is anxious to transfer the same to the Macon Gas, Electric Light and Water Company. His application to the Council for their consent was referred to the Mayor and City Attorney, with power to act in the premises. It is likely that the consent will be granted.

THE meter testing room of the New Haven Gas Light Company's workshop was recently the scene of a curious accident. An operator, while testing a meter, carelessly brought the flame of a lamp too close to the meter. The lamp flame was drawn by the the bellows into the meter and an explosion occurred that threw the tester violently to the floor.

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, AUGUST 19, 1889.

Odd Lots.

WE understand that the Montreal Gas Company will build another gasholder. This does not look as if Mr. Scriver is very greatly cast down over the loss of the public lighting, which is now entirely under the control of the electricians.

THE negotiations looking to the absorption by the New Bedford Gas Company of the local Edison Company are not progressing satisfactorily. The outrageous demand of the "parent" Edison Company, of this city, is the stumbling block.

THE authorities of Montclair, N. J., have interviewed Dr. Love, of the Gas Company, on the matter of improved public lighting for the thoroughfare known as Bloomfield avenue. The Doctor offered to keep the street gas lamps now in use on the avenue alight all night and every night in the year, if the authorities would agree to pay $21 per post per annum for such service. He also said that the Gas Company would submit a proposition for lighting the avenue by means of arc lamps. A $21 rate for gas street lamp lighting, on the schedule proposed, looks to be a very reasonable one.

A SUIT is now pending in the Court of Common Pleas, Philadelphia, Pa., that was brought at the instance of Alice C. Hill against Austin W. Graham and wife, hairdressers. The plaintiff was in the employ of defendants, and in May, 1889, sustained injuries through an explosion of gas in an oven used for the drying of hair. She claims that the oven was in a defective condition, and that her employers are responsible for their negligence in not keeping the apparatus at a proper standard.

LAST spring we reported the incorporation, in Galveston, Texas, of an opposition gas company, whose projectors proposed to distribute water gas. The petition for an ordinance was in due time presented to the City Council, where it slumbered until the 5th inst. On that date a motion for its adoption was defeated.

Mr. Geo. R. Hislop on Water Gas.

The following is from the inaugural address of Mr. G. R. Hislop, President of the North British Association of Gas Managers:

But we have yet another rival in the field in the form of water gas, and which may claim a passing notice. I need scarcely submit to you as a fact that the statements regarding this gas have been seriously exaggerated, and the credulity of the capitalists of the country tampered with. Few may venture to question the statement that the results obtained at the Leeds Forge were fairly successful, but that being so, it does not necessarily follow that the process will be equally successful elsewhere; and for certain reasons, which are now well understood, such as the fact that while a given weight of coke is convertible into from 30,000 to 35,000 cubic feet of gas, the former from Scotch and the latter from English coke, not more than one-third can be produced as water or lighting gas, and the remaining two-thirds heating gas only, which may be utilized in the raising of steam, heating furnaces, or for metallurgical purposes generally. Now, according to the showing of the promoters of the water gas scheme, this 35,000 cubic feet can be produced at a cost of 4d. per thousand cubic feet (not including cost of distribution), and as it would be quite impracticable for a central supply company to sell almost any portion of the heating gas, necessitating, as it would do, a special set of main pipes, the cost of the one-third would, on the Scotch basis of 30,000 cubic feet, be, say, 4.66d. per thousand cubic feet. But inasmuch as only one-third is available for lighting purposes, the rate per thousand must necessarily be raised to 4.66d., multiplied by 3, equal to 13.98d., and to which, if we add the cost of the magnesium comb necessary to produce incandescence, say, 3.5d. per thousand, we have 17.48d. per thousand cubic feet for a gas which of itself possesses no luminosity, is practically devoid of smell, its presence difficult to detect, and is dangerously poisonous if inhaled. Or if employed for heating purposes, this gas possesses only one-half of the heating power of common coal gas, and therefore is considerably less than half that of cannel gas. It will thus be seen that this gas cannot approach coal or cannel gas in value or efficiency.

The Market for Gas Securities.

Consolidated during the week advanced to 87 on small transactions, and it is quite likely to score a still further rise within the next month. The Standard Gas Company, of this city, has declared another quarterly dividend of 1 per cent., payable August 31st. The Brooklyn situation remains unchanged, although there is some demand for old Brooklyn, and purchasers are disposed to make concessions to holders. Baltimore Consolidated is at 44½, and Chicago Trusts are strong at 59¼. We note a sale at auction of Newark (N. J.) gas at 206½, 50 shares changing hands at that figure. We believe that the coming fall market will be all in favor of holders.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

AUGUST 19.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	87	87½
Central	500,000	50	—	—
" Scrip	220,000	—	—	—
Equitable	4,000,000	100	122	—
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	116	118
Mutual	3,500,000	100	102	103
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern	.....	50	—	—
" Bonds	150,000	—	—	100
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	60	70
" Bonds	15,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	107½	108½
Citizens	1,200,000	20	65	70
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	126	127
" Bonds	300,000		—	106
Peoples	1,000,000	10	71	76
" Bonds (5's)	368,000	—	97	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	88	91
Nassau	1,000,000	25	110	—
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	118	120
" Bonds	1,000,000	—	109	112
Out of Town Gas Companies.				
Boston (Mass.) Gas Co	2,500,000	500	240	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	170	—
" " Bonds	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	59¼	—
Cincinnati G. & C. Co.	6,000,000	100	214	218
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			80	90
Capital, Sacramento, Cal.			58	—
Consolidated, Balt.	11,000,000	100	44	45
" Bonds	6,400,000		107	107½
Hartford, Conn	750,000	25	120	130
Jersey City	750,000	20	175	180
Laclede, St. Louis, Mo.	2,000,000	100	140	—
Louisville, Ky	2,570,000	50	125	130
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	48	51
" Bonds	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal.			35	35½
Peoples, Jersey City		—	60	61
" " Bonds			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	99	100
Syracuse, N. Y.	500,000	25	—	—
St. Louis, Missouri	600,000	50	—	750
San Francisco Gas Co.			60	60½
San Francisco, Cal.	10,000,000	100	59¾	60
Washington, D. C.	2,000,000	20	195	198
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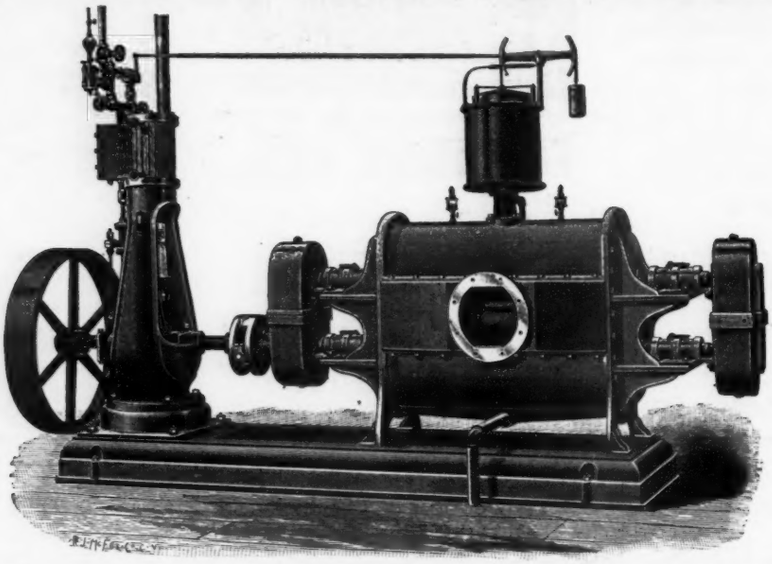

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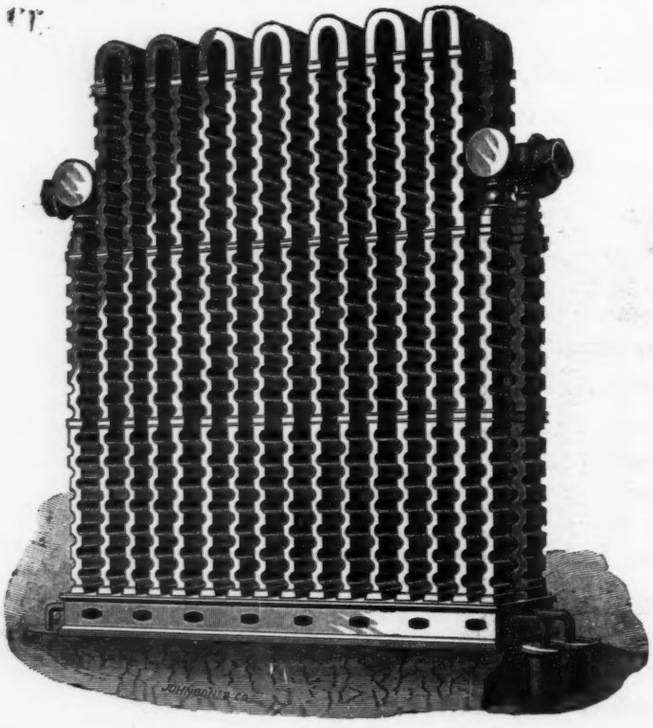

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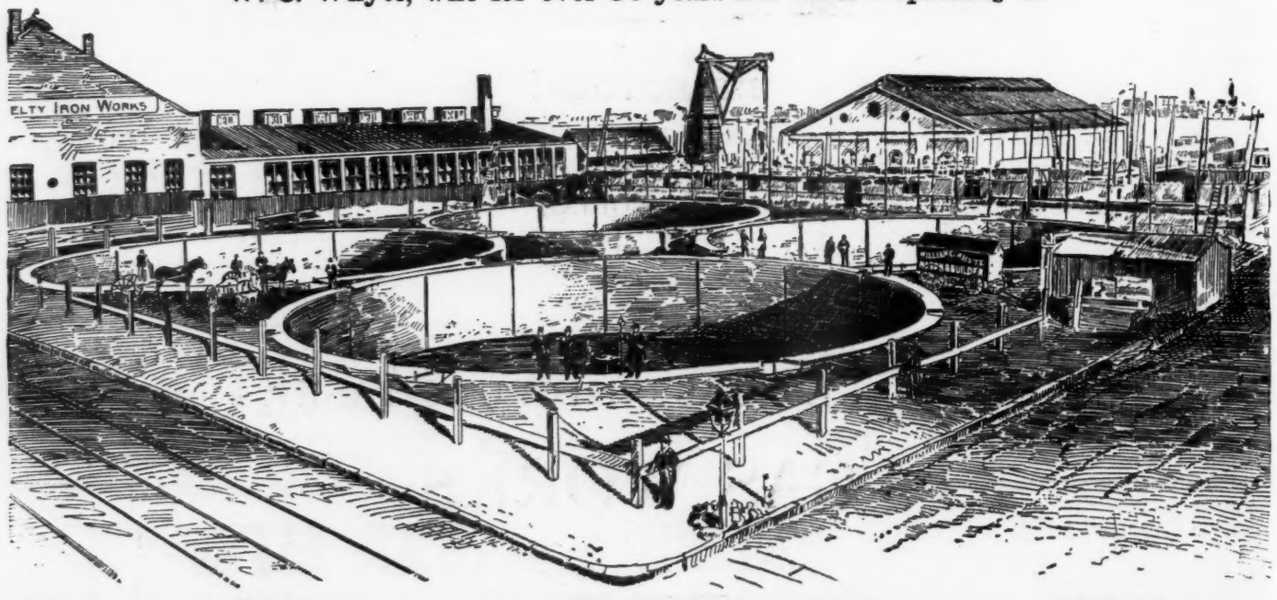

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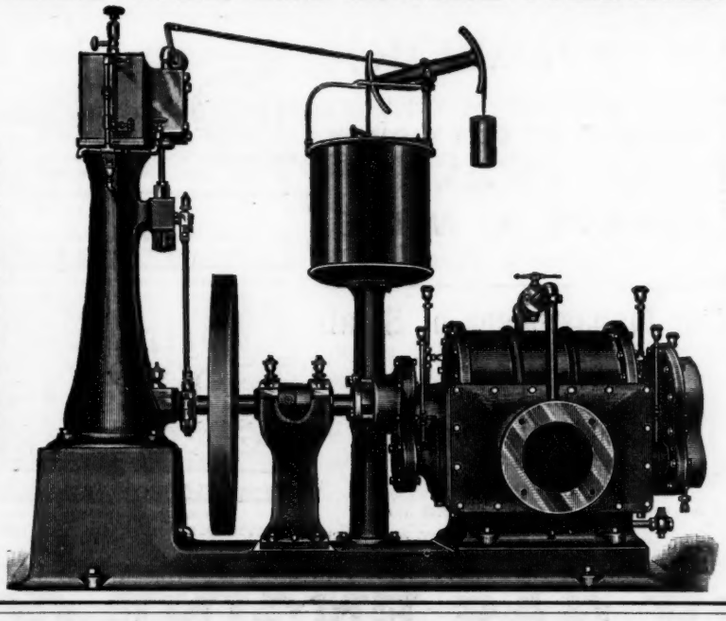

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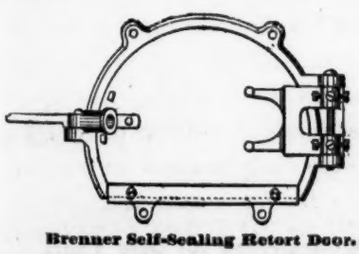

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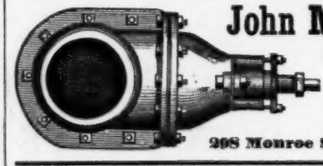

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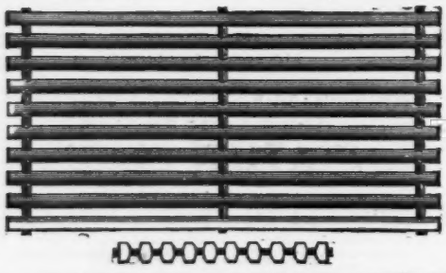

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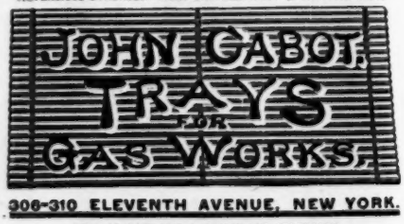

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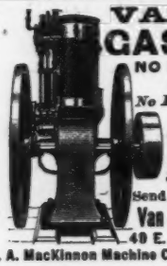

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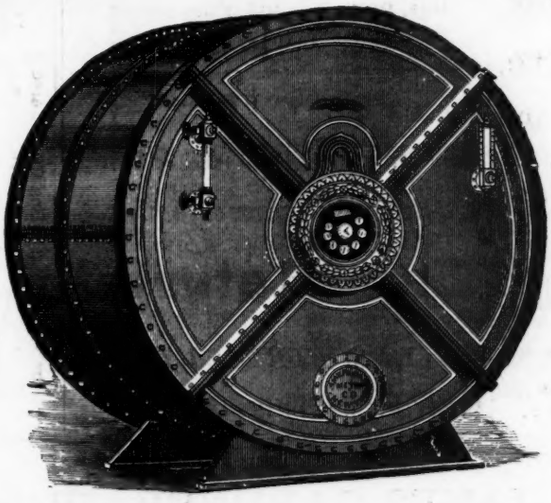

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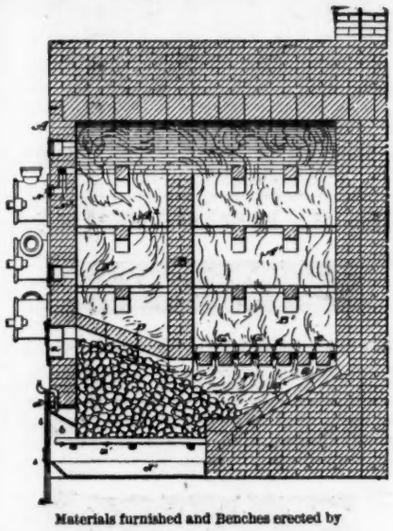

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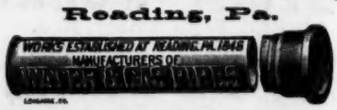

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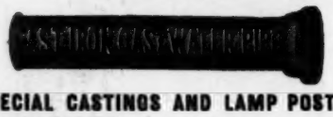

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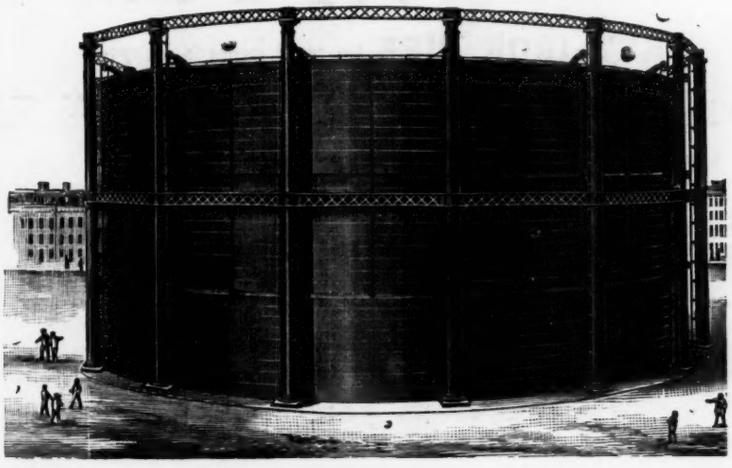

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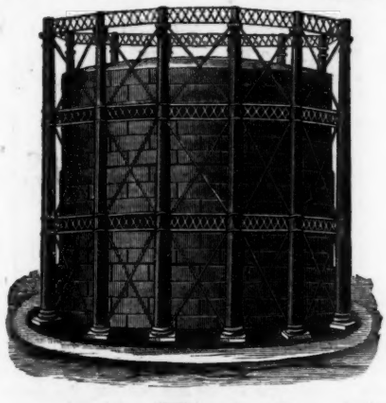

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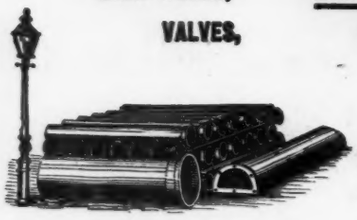

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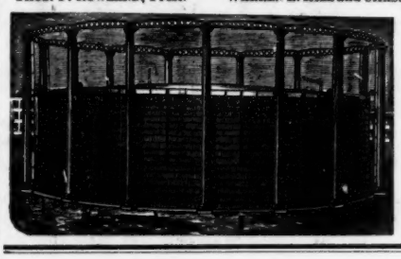

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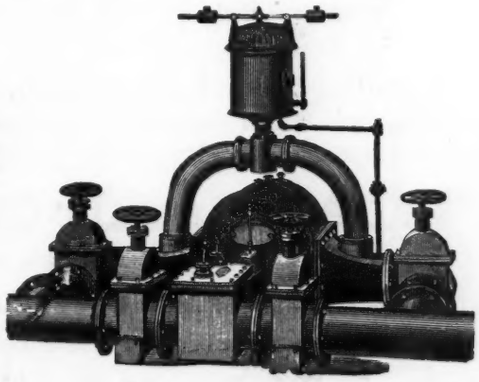

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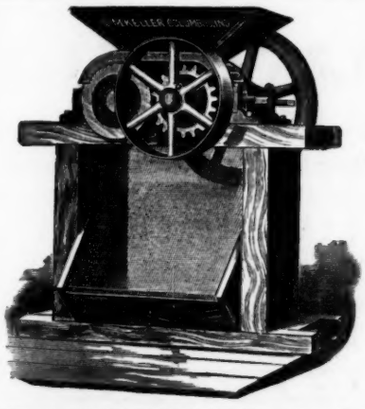

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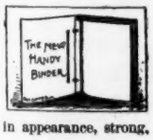

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37 in. high.	12 in. high.	11 in. high.	24 in. long.	36 in.
30 in. wide.	17¼ in. wide.	18 in. wide.	21 in. wide.	
	13 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crossp[illegible] and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
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17 in. wide.	14¾ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

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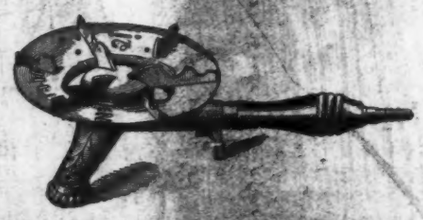

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Size, 6¼ inches diameter, [illegible] high. Consumption, 6 feet per hour at 1 in. pressure.

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